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ABSTRACT

Presented are the teacher and student editions for six modules designed to teach students how to investigate and evaluate science-related social issues. These modules (each of which includes an introduction, objectives, readings, and activities) focus on: (1) environmental problem solving; (2) preparing to investigate an environmental issue; (3) using surveys, questionnaires, and opinionnaires in environmental investigations; (4) interpreting data in environmental investigations; (5) investigating an environmental issue; and (6) environmental action strategies. Also included (in a preface) is: information on teaching for environmental literacy (examining the components of environmental literacy fostered in the modules); a discussion of eight variables crucial to achieving environmental literacy; introductory information (including grade levels and instructional time; assumptions on prerequisite knowledge; comments on instruction, skills, and evaluation; notes on values and values clarification; and brief comments on the results obtained from several studies on the use of the modules. (JN)

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Investigating and Evaluating Environmental Issues and Actions Skill Development Modules

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A Curriculum Development Project Designed to Teach Students How to Investigate and Evaluate Science-Related Social Issues

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Investigating and Evaluating Environmental Issues and Actions Skill Development Modules

A Curriculum Development Project Designed to Teach Students How to Investigate and Evaluate Science-Related Social Issues

MODULES I - VI

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INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

PREFACE

TEACHING FOR ENVIRONMENTAL LITERACY
INTRODUCTORY INFORMATION
(PROGRAMMATIC OVERVIEW FOR MODULES I-VI)

PREFACE

To The Instructor

Several years ago a local junior high school teacher sat in my office at SIU-C and complained bitterly about his school's science program. It was not, in his opinion, meeting the needs of the students. Further, he had gotten the feeling that there was some real interest, on the parts of the students, for studying science-related environmental issues. To give these students an opportunity to investigate these issues was his goal. Unfortunately, it was apparent that they lacked the skills to do so. What was the answer?

The modules from which you are reading are the fourth edition of "the answer". Over the years, this skill development program - culminating in autonomous research by the student - has been refined and thoroughly researched. In fact, in the mid 70's the modules were chosen as an outstanding, innovative science program by the National Science Teachers Association. Even so, many have been the critics of the modules. Teachers have commented vociferously that junior high "kids" simply couldn't do the things expected of them in independent research. They didn't have the ability . . . there would be serious discipline problems . . . this wasn't how they were taught to teach . . . they would lose control of their classes . . . on and on! As it turned out, these fears were and are unfounded. The teachers who believed in and used these modules have found that students can do the work. There are no serious discipline problems. There was class control.

But, using the modules does demand a new style of teaching for many instructors. It demands that the students and teacher trust one another. It demands that the teacher be willing to give up being the focal point of instruction (especially during Module V) and serve as a consultant, resource person, and enthusiastic supporter of the students' efforts. Interestingly, those teachers with a willingness to do this have found the experience satisfying and, in large part, the students grateful for the experience.

Parent acceptance of the modules also seems to be positive. I can recall one evening in New Jersey after visiting a critique session in a junior high school where the modules were being used in a team teaching effort. I was introduced to a parent whose son was involved in the investigation phase of the program. The father said, "This is the first time in eight years of schooling that my son has had a meaningful assignment in school!" This was probably a bit of an overstatement but it certainly made me feel good about what we were trying to accomplish. Teachers report enthusiastic acceptance by other parents, not only in New Jersey but in other states as well.

At what grade levels should the modules be used? They were developed to be used primarily at the junior high school level. However, they have also been used by one of the developers at the senior high school level with success. And, surprisingly, we find that they have also been used at the undergraduate level in college. It is reported to us that many of the college students lack the skills taught here. Given that they have also been used with gifted learners at the fifth grade level as well, this would indicate that there is a wide variety of grade levels at which the modules can be used effectively.

Research conducted on the modules in both suburban and rural school settings shows rather dramatically that junior high students become more able to identify problems, conduct the research, and investigate and evaluate possible solutions for societal issues. Further, and perhaps more importantly, research has shown that students who have been trained using these modules become far more active in their communities in a citizenship capacity. This observation, although extremely satisfying, was not totally expected by the developers. Yet, it did occur and this is exactly what education should be doing - developing active and responsible citizens.

A very few years ago, a national research publication called Project Synthesis called for a revolution in science education at all grade levels, K-12. Project Synthesis emphatically states that there are four major goals for science education. One of these is for citizens to learn to effectively deal with science-related societal issues. That science teacher who sat in my office many years ago was years ahead of his time. Because he was, there now exists a proven program for helping meet at least one of the crucial goals of science education.

Harold R. Hungerford
January 1985

TEACHING FOR ENVIRONMENTAL LITERACY

The authors of INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES have attempted to create a curriculum package which will assist middle and junior high school students in becoming environmentally literate. The modules are predicated on a particular definition of environmental education and a particular framework for environmental literacy. The definition of environmental education is as follows:

> ENVIRONMENTAL EDUCATION: . . . that part of education that deals with culturally-imposed, ecologically-related issues in the environment . . . further, the acquisition and application of human values as they relate to the use and misuse of both living and nonliving resources.

This definition focuses on an issue orientation -- issues which man has created and which have ecological implications. It also recognizes that issues are value related and that human values, in large part, dictate how the earth's resources are to be used.

Wise use of the earth's resources may well rest in the creation of an environmentally literate world society. Such a literate world society would possess those attributes which would help human beings resolve current issues and provide them with the skills needed to cope with future ones.

Another way to vew environmental literacy is to identify its components. This was done by Harold R. Hungerford and R. Ben Peyton. Included in these literacy components is what is referred to as a Superordinate Literacy Component and four subordinate ones.

Literacy Components

The Superordinate Component: The environmentally literate citizen is able and willing to make environmental decisions which are consistent with both a substantial quality of human life and an equally substantial quality of the environment. Furthermore, this individual is motivated to act on these decisions either individually or collectively.

Subordinate Literacy Components: These are the components which exist beneath the superordinate component discussed above.

> Literacy Component I - Ecological Foundations: At this level, the receiver (learner) has sufficient knowledge of ecology to permit him/her to make ecologically sound decisions with respect to both humans and the environment.

Although it is difficult to pinpoint exactly that ecological knowledge which is critical and prerequisite to sound environmental decision making, certain key concepts and allied ecological principles appear crucial. Therefore, the writers believe that the principles associated with the following concepts need to be understood in order to permit the application of these principles to environmental decision making.

A. Individuals
B. Population (Population Dynamics)
C. Interaction
D. Interdependence
E. Limiting Factors
F. Energy Transfer
G. Biogeochemical Cycling
H. The Community
I. The Ecosystem
J. Homeostasis
K. Succession
L. Man as an Ecological Variable

Literacy Component II - The Awareness of Issues and Human Values: This component, like the previous one, seeks to provide the learner with information. Rather than ecological information, however, this component deals with a wide variety of so-called environmental information. Again, it might be said that this information or knowledge is prerequisite to the actual investigation, evaluation, and remediation of issues.

The environmentally literate person then, at this level, understands (conceptualizes) . . .

A. . . . the way in which human cultural activities impact on the environment. Here, cultural activities would include economics, religion, politics, social customs, etc.

B. . . . the way various individual behaviors impact on the environment.

C. . . . a wide variety of environmental issues and both the ecological and cultural implications of these issues.

D. . . . the various alternative solutions available for solving (or partially solving) discrete environmental issues. Of critical concern here would be the ecological and cultural implications of these various solutions.

E. . . . the need for thoroughly investigating and evaluating issues prior to taking environmental action.

F. . . . the roles played by differing human values in environmental issues. Also, an understanding of the genesis of these varying values appears crucial.

G. . . . the need for personal values clarification as an integral part of environmental decision making.

H. . . . the need for responsible citizenship action in the solution of environmental issues.

Literacy Component III - The Investigation and Evaluation of Issues and Solutions: This component, unlike the previous two components, goes beyond the acquisition of information per se. Level III deals with the development of those skills necessary for the actual investigation and evaluation of environmental issues. Further, it provides for the evaluation of alternative solutions for solving issues.

The environmentally literate person then, at Level III, has those skills enabling him/her to . . .

A. . . . identify and investigate environmental issues using both primary and secondary sources of information.

B. . . . analyze environmental issues with regard to the various perspectives associated with those issues. Further, the receiver is able to identify the ecological and cultural implications of these value positions.

C. . . . identify alternative solutions for discrete issues and the value perspectives associated with these solutions.

D. . . . evaluate alternative solutions for discrete issues with regard to their ecological and cultural implications.

E. . . . identify and clarify his/her own value positions related to discrete issues and the solutions proposed for those issues.

Literacy Component IV - Citizenship Action: This component deals with those skills necessary for learners to take appropriate environmental action.

The environmentally literate person, at Level IV, has those skills enabling him/her to . . .

A. . . . take either individual or group action (i.e., persuasion, consumerism, political action, legal action, eco-management) where appropriate for the purpose of solving or assisting to solve particular issues.

B. . . . evaluate actions taken with respect to their impact on quality of human life and quality of the environment.

Literacy, then, begins with knowledge and ends with action. Although these literacy outcomes are, by and large, hierarchical in nature, there are many instances where two or more components or subcomponents can be acquired simultaneously, e.g., certain ecological knowledge and issue knowledge or issue information and the alternative methods of investigating those issues. In fact, to assume that each literacy component or subcomponent must be acquired independently of others is probably educationally unsound. There is far too much overlap between many of them. Therefore, although hierarchical in nature, environmental literacy outcomes are interdependent and should be learned in a manner which is logical and defensible.

ACHIEVING LITERACY - WHAT'S INVOLVED?

As was stated earlier, environmental literacy starts with knowledge and ends with action. Although the statement sounds simple enough, its achievement is a most complex task. Research on responsible citizen action and the factors which influence that action has been undertaken. What this research has discovered is complex and what remains to be discovered is substantial. Nonetheless, it is important that instructors who use the modules become aware of what is known about the development of responsible citizenship behavior.

At present, it seems that there are eight variables which appear to be, both individually and collectively, crucial to environmental literacy. These are:

1. knowledge of issues
2. beliefs concerning issues
3. an individual's values
4. a person's attitudes
5. locus of control
6. environmental sensitivity
7. knowledge of and skill in environmental action strategies
8. ecological concepts

Each of these will be commented on in the following pages.

First of all, knowledge about issues - in and of itself - is not enough to promote responsible citizenship behavior with respect to solving environmental issues. The reliance on knowledge to get the job done is commonplace in EE. Yet, most research shows that an awareness of issues (i.e., simply knowing about them) is insufficient in terms of changing behavior. There is some evidence, on the other hand, that indicates that an indepth investigation of an issue may promote changes in human values and lead to overt action with respect to that issue - at least with some individuals. However, in this instance, the investigation or information input must be thorough and fairly exhaustive.

Secondly, a person's perspective about an issue depends heavily upon his/her beliefs. A belief is nothing more than an idea that a person holds to be true. A belief may or may not be accurate, i.e., it may or may not, be substantiated by reality. If the belief is erroneous, the individual's values and attitudes (and more) can be biased in an ecologically faulty manner. The idea that, "Having three or more children poses no environmental threat" is a belief statement. It describes what an individual perceives to be reality. In this case, the belief is probably wrong. It does not describe a true relation between family size and ecological stability (from a population dynamics perspective). It goes without saying that it becomes important for the environmental educator to provide information concerning issues that is both accurate and thorough.

Third, how a person feels or behaves with respect to an issue is closely related to his/her values. A value, here, is defined as the relative worth an individual places on something. The comment, "Large familes are both beautiful and desirable" implies, perhaps, both aesthetic and social values placed on large families by the individual. Note that the value component is different from the belief component although, in this instance, they are compatible with each other.

Fourth, attitudes are also involved in this analysis of the task of achieving environmental literacy. And, attitudes are difficult to define because they are complex entities. An attitude may be defined as a complex mental construct (perception) which emerges out of an integration of an individual's belief and value systems. Attitudes are also characterized as perceptions that predispose an individual to behave in certain ways. This, however, is open to argument in that an attitude which has not fully matured, or of which the individual is not fully conscious, may not produce a particular behavior. In any event, attitudes are typically considered to have knowledge, emotional (affective) and behavioral components.

Thus, attitudes may often be considered as perceptions or complicated mental constructs that result from a personal integration of beliefs, values, and behaviors. Just how these components interact with each other is uncertain. Researchers are just not sure how the variables interplay. Even so, some things that are important, are known. For example, an individual may reject new information out-of-hand if it disagrees with a strong value perspective or belief system which has been handed down by a loved or respected parent/friend. An individual who has strong anti-abortion beliefs and values will probably reject the idea that abortion is an important contribution to population control. Those who reject abortion may well turn to arguments like chastity, sex education, birth control, or adoption of unplanned offspring as the only viable alternatives to abortion even though there is a mass of evidence that indicates that chastity may be largely a moot issue, few readily available contraceptives are foolproof and many adolescents and young adults will not turn to them for protection, and adoption still places an additional child into the population. In other words, social forces may well dictate attitudes irrespective of enormous bodies of knowledge which would indicate a need for alternative beliefs/values/attitudes.*

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*-With an issue as volatile as abortion, it would be a simple matter for the reader to transcend logic and focus on this section's content from an emotional frame of reference. Interestingly, this particular paragraph could be interpreted by different individuals as neutral, pro-abortion, or pro-life. In fact, it should be interpreted only as a vehicle for noting the tremendous disparity that can exist between scientific data, personal beliefs, and personal values. Until issues such as this can be viewed objectively and rationally, they will be extremely difficult to resolve.

This integrative process goes one step further. Generally, values impinge upon attitudes to a greater degree than knowledge (beliefs). It is known that values are used to screen new information that may be modified or rejected as a function of those highly-prized values. If attitudes/behaviors are to be changed in the case of a highly volatile issue, some form of dissonance must be perceived by the individual regarding irreconcilable differences between his/her beliefs and values. In the case of population, the individual must come to value human population stability and the ecological implications for same. If such a value can be internalized, new information supporting that value will be processed and integrated into the attitude which predicts behavior. No one is certain of how this is accomplished. What is certain is that, with an issue as volatile as this one, the evolution of new attitudes may be hard to come by. The answer probably lies in a close inspection of personally-held values (value clarification) combined with accurate and fairly thorough information concerning a broad spectrum of topics, e.g. population dynamics, human population projections, immigration problems/patterns, birth control, cultural biases toward family size, ecological implications of eruptive populations, etc.

In order to promote appropriate attitudes/behaviors, environmental educators must deal with the beliefs and values of students. This is a real problem when one realizes that each learner has a unique set of beliefs and values which results in a very personal frame of reference concerning an issue or group of issues. Further, indoctrination of students is undoubtedly counterproductive. To directly confront a student's value system will probably result only in a deepening commitment to previously held values. In addition, indoctrination is highly unethical. In a democratic society, educators must strive for honesty in instruction and the development of effective problem solvers and participatory citizens. If teachers help students to become skilled problem solvers (e.g., investigators and evaluators of environmental issues) the students will probably sort through their own values with respect to environmental concerns and, in almost all cases, line up on the side of environmental integrity. The reader should note that these words are more than just "catch-phrases" in education; there is evidence that this prescription does, in fact, work.

Fifth, how a person behaves is related to a phenomenon called locus of control. Locus of control is a factor associated with an individual's perception of whether a particular behavior will result in an anticipated reinforcement for doing (acting). This is called expectancy of reinforcement.

Some individuals believe that they are in control of situations that demand action. These individuals have a high expectancy of reinforcement. Such people are said to possess an internal locus of control. Internal locus individuals would tend to take action on an issue because they feel that their actions would, in some way, help alleviate the issue.

On the other hand, some individuals believe that they are not in control. Therefore, they have a low expectancy of reinforcement. These individuals are said to have an external locus of control. This simply means that the control over a situation lies external to the individual - at least, the external individuals believe that. External people may, for example, believe that "powerful others" are in charge and will dictate the outcome of a problem or issue.

Going back to the population issue for a moment, let us take a look at locus of control in that context. Who, for example, would be expected to use birth control methods while engaging in coitus? One would expect birth control to be utilized widely by people who felt in control of conception. And, research indicates that this is correct. Internals tend to use contraception while externals tend not to.

Are internals and externals consistently one way or another? Research is unclear on this point although we know that some individuals have a marked external nature while others reflect an internal nature. But, there is also some evidence that indicates that people may be internal in certain situations and external in others. There is also some evidence that indicates that some individuals can, indeed, be motivated to move from an external perspective to an internal one. If this is correct, there are important implications here for environmental education. Although it is unclear precisely what factors are involved in such a change, it is probable that an external will move toward an internal perspective if he/she: (1) understands the issue in depth, (2) believes that action is called for, and (3) knows what action is going to maximize the possibility of exercising control over the outcome. If this is correct, environmental educators should focus on crucial issues (rather than ones typically considered), delve into issues in depth, and provide training in citizenship action skills that can be applied to those issues.

Sixth, an individual who has a high degree of sensitivity toward the natural environment is more prone to deal with the environment in ecologically appropriate ways than others. The sensitive individual (all other things being equal) is the one who . . . refuses to litter highways and natural areas . . . conserves natural resources . . . works to preserve ecologically important natural areas . . . strives for ZPG . . . respects hunting and fishing laws . . . insists on rational zoning requirements . . . etc.

What is environmental sensitivity? It is, by and large, an empathetic or understanding view of the environment. It is a view that respects ecological integrity and one that believes that humans must live, somehow, in ecological harmony with the natural environment.

If sensitivity is such an important variable, why not focus on it solely and change the perspectives of every youngster in the schools of the world? Unfortunately, this is easier said than done. A high degree of sensitivity seems hard to come by. Research, again, indicates that the very sensitive individual is one who grew up closely allied with a natural setting and spent considerable time in that setting - or, experienced the loss of a highly regarded environment, e.g., a much-loved forest being cut down to make way for a shopping center. Some sensitive individuals report another variable as being crucial. That variable is associated with role models. The person(s) who acted as the role model(s) demonstrated a high degree of sensitivity that was emulated by the recipient of that experience. Role models were often members of the immediate or extended family. In a surprising number of cases, the role model was a teacher.

Being that teachers were sometimes reported to be precursers to sensitivity, there is some opportunity for the development of sensitivity by teachers. However, the teacher would have to fit the sensitivity model rather well, reflect it diligently, and have such a positive relationship with students as to make them eager to associate with that posture. How many teachers are willing to express that level of dedication to their charges? Probably only a few will be so inclined. Thus, it becomes obvious that the school is situated so as to have relatively little control over the development of intense environmental sensitivity. This may be in part, an ominous sign.

Seventh, there is some evidence to indicate that individuals who are knowledgeable about environmental action strategies and skilled in applying them will, in fact, use them in an effort to remediate issues. Research is not certain as to the entire meld of variables associated with this phenomenon but it appears to be an important one. If, in fact, students can be taught about citizenship actions and trained in their use, more citizens would eventually confront environmental issues. Plus, unlike sensitivity, environmental action can be taught in the classroom. This has been demonstrated numerous times by both teachers and researchers interested in environmental education. The teaching of environmental action in classrooms across the nation could well be the key needed to unlock the door to some semblance of environmental integrity, nationwide.

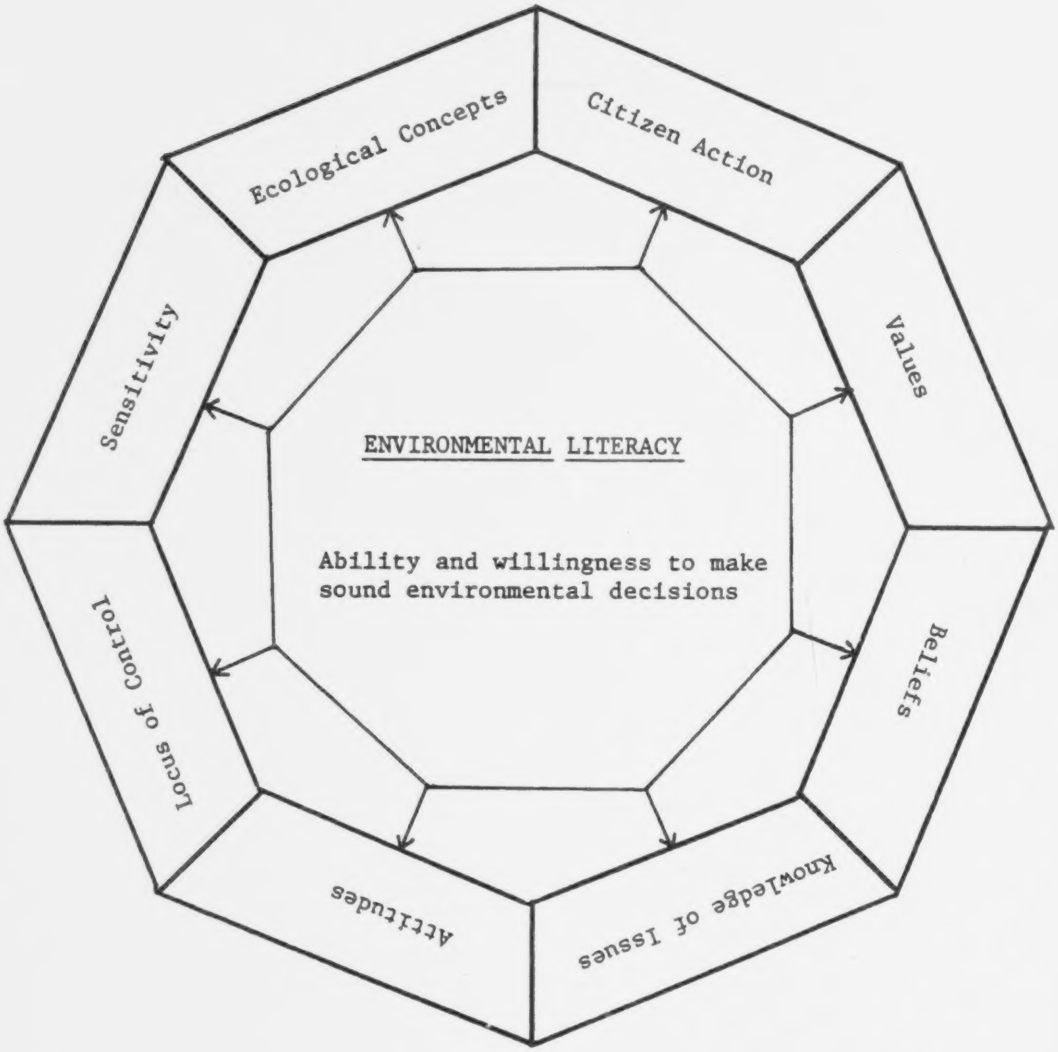
Eighth, and lastly, a knowledge of basic ecological concepts seems to be an imperative in the development of environmental literacy. Although this may seem, on the surface, to be an unimportant variable, it may be pivotal to the entire process. Why?

When an individual makes a decision concerning an issue, that decision will have ecological consequences if carried out. Thus, it is imperative for the individual to be able to assess the ecological consequences of a given decision. You may recall that, earlier, the superordinate goal of EE was presented. This goal states that environmental decisions should be made which are consistent with both a quality of life and an equally substantial quality of the environment. Environmental quality is, in large part, dependent upon the ecological integrity of that environment. Thus, ecological concepts become crucial to the decision-making process.

A model of these variables is presented on the next page. Exactly how these variables interact with each other is unknown. However, the crucial nature of these eight conditions must not be ignored and kept out of the classroom simply because it is not known for sure how they interact. What is known is that certain of these, by themselves, will not result in an environmentally literate citizen.

As you examine the contents of the six modules of this curriculum package, you will find that they focus on knowledge of issues, beliefs, values, attitudes, and action -- five of the model's components. This focus, in turn, addresses all of the literacy components with the exception of ecological foundations. INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES should assist, to a great extent, in helping students become environmentally literate.

IMPORTANT VARIABLES ASSOCIATED WITH ENVIRONMENTAL LITERACY


Ecological Concepts
Citizen Action
Values
Beliefs
Knowledge of Issues
Attitudes
Locus of Control
Sensitivity
ENVIRONMENTAL LITERACY
Ability and willingness to make sound environmental decisions

This figure illustrates the important variables associated with environmental literacy which are discussed in this section. Note how each of these is shown to interact with all others. Although research has not revealed the exact nature of these interactions, they most certainly do occur.

INTRODUCTORY INFORMATION

The INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES have been developed to accomplish a dual purpose. First, they are designed to prepare middle and junior high school students to investigate environmental issues in an autonomous manner. The first five modules afford the student an opportunity to become an independent researcher into environmental issue areas. These modules set the scene for research and make provisions for it.

However, the authors believe that research without subsequent environmental action is not enough to make an individual environmentally responsible. Hence, a second purpose of these modules is to introduce students to the various modes of environmental action so that they might couple environmental issue awareness with activity which initiates constructive change. Module VI has been developed to present various action strategies and provides activities for both surrogate and real environmental action planning. The final and ultimate step - that of initiating and completing the planned action - is a decision left up to the instructor and his/her students.

These modules have been written as a consequence of the awareness of the authors that middle school students are ill-prepared to research environmental issues using primary and/or secondary sources of information or to take positive action. Early attempts to provide a learning climate in which middle school students could apply their own environmental interests to a research-oriented strategy failed, even under the direction of highly competent instructors. The students simply did not have the skills necessary for a successful interaction with environmental issues. This modular design has been developed to provide those skills so that students of varying abilities can become truly autonomous learners and responsible action takers.

The actual training (skill development) portion of the INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES (Modules I-IV and VI) takes approximately a few weeks longer than one semester to complete with students of middle/junior high age - somewhat longer perhaps with younger students. However, this still leaves adequate time in the school year for indepth research conducted by the student. It also allows for sufficient time to engage in environmental action projects based on the autonomous research they have accomplished. It may occur that the class as a whole may choose a single group action project which they can plan and carry out. It is the hope of the authors that students will reach a point (after interacting with these modules) at which they desire and do take action based on the research they have done.

GRADE LEVELS AND INSTRUCTIONAL TIME

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES has been successfully taught with students from sixth through tenth grade as well as college level students. The sophistication of the autonomous research projects accomplished by these students rests in the maturity level and skill competence at a particular grade level. All modules can also be used with gifted populations at intermediate elementary school grades. Care has been taken to maintain a reading level commensurate with students of these grades or abilities.

Many variables impinge on teaching the modules just as on any other instructional strategy. However, an instructor should plan on a minimum of one semester (18 weeks) of instruction for Modules I-IV and VI considering a five-day week and a time block of fifty minutes per day. The time needed for Module V varies greatly depending on the nature of the research conducted. Some students can effectively engage in autonomous research in less than six weeks--others require a longer period of time. The time necessary to complete a planned action project will vary with the project chosen and the competence of the students.

ASSUMPTIONS ON PREREQUISITE KNOWLEDGE

A successful grasp of the materials presented in these modules is predicated on the assumption that the students have a foundation in the basic ecological principles which explain the operation of the biosphere. Knowledge of energy transfer, population dynamics, homeostatic balance, community and ecosystem interactions, etc. is essential for understanding the ecological basis of environmental issues and solutions. The authors of the modules have assumed that students will have much of this information. This assumption may be faulty in some instructional situations. Therefore, the following references are recommended for those instructors who feel that their students need ecological foundations before they engage in the materials presented here.

Materials on Ecological Foundations

Title	Supplier
Interaction of Man and the Biosphere by Norman Abraham et al. (textbook, 7th-8th grade)	Rand McNally and Company P. O. Box 7600 Chicago, Illinois 60680
Basic Ecological Concepts by Audrey Tomera (worktext, 6th-8th grade)	J. Weston Walch, Publisher 919 Congress Street Portland, Maine 04104
Ecology: Interrelationships in Nature by H. R. Hungerford and A. N. Tomera (8 sound filmstrips)	Society for Visual Education, Inc. 1345 Diversey Parkway Chicago, Illinois 60614

COMMENTS ON INSTRUCTION, SKILLS, AND EVALUATION

Like so many teaching strategies, the success of this modular design depends to a large extent on the teacher. As with any learning experience, the student becomes more proficient under a dynamic, empathetic, and cognitively demanding instructor. The skills under development in these modules then, will be developed commensurate with the standards established by the instructor. Even though performance objectives are specified for these modules, the successful acquisition of the skills involved usually lies somewhere along a continuum ranging from marginal achievement to outstanding criterion performance. It is up to the teacher to guide the students as close to criterion performance as possible. Achievement less than this will be reflected in the students' subsequent ability to do research, i.e., cope effectively with Module V and action projects chosen after interaction with Module VI.

The skills under development in these modules are definitely not restricted to science per se. They include the investigation skills of science but also many of those normally associated with the social studies and language arts, e.g., written communication, identifying and clarifying values, letter writing, writing summaries, library reference skills, conducting surveys, collecting opinionnaire data, and using questionnaires. The action modes discussed in Module VI carry on the integration of subject matter in a relevant societal context, e.g., analyzing written communications, identifying and clarifying values, proceeding with due political process, conducting product environmental impact and evaluating the ethics of action methods.

The integrated nature of the skills impinging on environmental education makes a logical case for an interdisciplinary teaching approach to this area. Where a school is departmentalized, cooperative planning and implementation of this modular strategy by the teachers of English (language arts), social studies, and science is recommended. However, if necessary, either the well-trained social studies or science teacher can handle it alone. The modules can also be effectively taught by a generalist in a self-contained classroom setting.

The authors have used a particular teaching technique in developing the student materials of Modules I-IV. As each topic or behavior is introduced to the students, it is first identified, defined or operationalized for the reader. Next, the skill or behavior is then modeled for the students using the proper format or guidelines identified in the first step. In the final stage, the student is given an exercise in which he can apply both the definition and model in an actual situation. This format of skill identification, a model and an application situation is felt to be a firm foundation for learning. If at any time, the instructor feels that further application situations are necessary, he should not hesitate to provide them for the students. The skills approached in the modules are similar, if not the same, as investigation and action skills needed in many everyday life experiences. The modules also encourage the transfer of investigation and action skills to many phases of decision-making. Transfer is a much cherished goal of education and to this end these modules are dedicated. Students and adults live in a world where they should make decisions and take actions based upon sound logic and information. As instructors, it is our responsibility to begin to give children the opportunity to learn how to do this.

Every effort has been made to produce a modular strategy that incorporates a hierarchy of skill development. This hierarchy necessitates close attention to the sequence in which the modules are taught. The authors recommend that students be exposed to the modules in the sequence in which they are written. Module V, Autonomous Research, requires students to reach criterion performance on the skills presented in previous modules. Module VI should be approached after the students have done their research. It appears to be pedagogically sound to initiate an introduction to action and action planning after students are proficient in identifying and researching environmental problems. They can then apply their expertise to environmental action and can more clearly see the relevance of the materials presented in Module VI.

Although careful sequencing of materials should be followed, it will sometimes be the case that a particular group of students will already be proficient in some of the skills covered in Modules I-IV. It is recommended that the instructor assess the students to ascertain this proficiency and then move on to more pertinent module materials rather than belabor unnecessary material.

As stated earlier, the modules have been developed to incorporate a hierarchy of skill development. The entire program begins with instruction in analyzing issues and ends in independent research and action planning which demands student application of a number of related skills. Further, at each step of the way, a product is produced by the student to enable the instructor to evaluate progress. No formal tests are used in any of the modules. However, performance objectives are specified for each of these modules and presented to the student. Since evaluation is implicit in the training activities of Modules I-IV and VI, performance in terms of the objectives appears to be a most logical means of evaluation. The ultimate evaluation, however, lies in the products produced by students during their autonomous research (Module V) and overt action behavior (Module VI).

NOTES ON VALUES AND VALUES CLARIFICATION

By virtue of the subject matter of Module I and Module VI, the instructor must become well-versed in language arts techniques, economics and political science content of the social studies and ecologically related science topics. These modules contain the essence of environmental education--an interdisciplinary approach. Perhaps the most important teaching skill to be used with these modules is use of values clarification techniques. In most activities conclusions and answers are not cut and dried. Students should be encouraged to analyze issues, weigh actions, and estimate environmental costs. The instructor's task is to challenge the student's thinking, query the correctness of the content base which the students use in choosing alternatives and, above all, allow for and prompt the exposure of as many values as exist within the classroom and/or world concerning issues and actions. Emphasis on values clarification is sound. Modeling of values can be another sound teaching tactic. However, students see so many conflicting values being modeled that no guarantee exists that "appropriate" values will be adopted. Research indicates that didactic teaching of values is ineffective. At this point in time, values clarification seems to be the best alternative for dealing with values in education.

Teachers have often asked whether they should let their own values be known to their students. By all means, share your values with your students.

But share them as being but one way to view a situation--not dogmatically. An open atmosphere of free, respectful exchange between students and between students and teacher will increase the value of the activities in the modules.

The following definitions are presented here to aid the instructor as he or she proceeds through the modules:

Attitude: A person's favorable or unfavorable expression toward a class of objects or events.

Belief: An idea which an individual holds to be true.

Environmental Issue: A particular interaction between man and his surroundings about which there are differing beliefs and human values.

Value: A guiding force that determines the choices people make in living their lives; a cluster of attitudes which generates either an action or a decision to deliberately avoid an action.

Value Modification: An internal process through which new value positions replace old value positions held by an individual.

Values Clarification: A process through which an individual's attitudes, beliefs, and/or values become clearer and meaningful to him or her.

For indepth discussions of values and values clarification techniques, the teacher is referred to the following sources:

Harmin, M., Kirschenbaum, H. and Simon, S. Clarifying Values Through Subject Matter. Minneapolis, Minnesota: Winston Press, 1973.

Hawley, R. and Hawley, E. Human Values in the Classroom: A Handbook for Teachers. New York: Hart Publishing Company, 1975.

Kirschenbaum, H. and Simon, S. Readings in Values Clarification. Minneapolis, Minnesota: Winston Press, 1973.

Kniker, Charles R. You and Values Education. Columbus, Ohio: Charles E. Merrill Publishing Company, 1977.

Raths, L., Harmin, M., and Simon, S. Values and Teaching. Columbus, Ohio: Charles E. Merrill Books, Inc., 1966.

Scherer, D. Personal Values and Environmental Issues. New York: Hart Publishing Company, 1978.

Simon, S., Hower, L., and Kirshcenbaum, H. Values Clarification: A Handbook of Practical Strategies for Teachers and Students. New York: Hart Publishing Company, 1972.

Knapp, Clifford. "Attitudes and Values in Environmental Education." The Journal of Environmental Education, 3 (Summer, 1972), 26-29.

RESEARCH RESULTS

The 1972-73 school year saw the modules used for the first time. Further, the modules were only about 60 percent complete when students were first introduced to them. There was considerable question as to whether the modules should be used or whether they could even be marginally effective if used in part. The decision was made to "go ahead" and the modules were trial tested with 125 heterogeneously grouped eighth graders. The developers were not at all displeased with the results of the training aspect of the trial teaching and decided to pre-post the students concerning their values before and after autonomous investigation (Module V). A simple phenomenological evaluation was used and the critical question was the following: "What do you feel you should do as a citizen regarding this particular problem (the one chosen for autonomous investigation)?"

Students' pre and post responses were compared. Responses were evaluated in terms of how many value positions were stated or inferred in their responses as well as whether shifts in values took place. It was found that values did, indeed, shift in many instances. The directionality of shifts in value positions was not analyzed because any evaluation of the degree of "goodness" or "badness" of students' values would be, in effect, an imposition of the writers' own values on the stated or inferred value positions of students. Even so, the writers were pleased with what they observed.

In 1975, a second research study was conducted by R. Henry Bisaga[1] of Carbondale, Illinois. This study empirically examined the question of whether fifth and eighth grade students' values would shift as a function of the modules. Students were pretested immediately after deciding on the topic they would investigate in Module V. They were posttested upon the completion of their research.

The fifth and eighth graders' responses to the evaluation were similar and therefore, the data were collapsed. Pretest responses were statistically compared to posttest responses. When students were asked what they felt they should do as a citizen regarding this problem, posttest responses differed from pretest responses to a statistically significant degree in favor of the posttest. Even higher pre to post differences were obtained when the students were asked if they actually believed that they would do something about the problem and, if so, what they intended to do. These results indicate that students' verbalized values do, indeed, shift as a function of autonomous research on an environmental problem of their choosing and, in particular, with respect to environmental action.

A third research project was conducted by John Ramsey[2] of Red Bud, Illinois. It's purpose was to measure the effects of instruction in investigation and action skills on the overt environmental action of junior high school students. Students' knowledge of investigation and action skills as well as their attitudes toward environmental problems were also investigated. The effectiveness of the modules was also compared to instruction in awareness of issues using a case study approach. Both of these types of instruction were compared to a control group which received science content instruction.

Analysis of pretest scores of all groups indicated that they were equal at the onset of instruction. Posttest scores were analyzed using an analysis of variance technique. Posttest results indicated that the students given instruction in environmental action problem-solving skills surpassed both of the other groups to a statistically significant degree in 1) knowledge of environmental action skills and 2) overt environmental actions. A questionnaire which collected parental observations of students' environmental behavior both during and after instruction was used as a corroborative cross-reference for the self-reported student data. The parents were unaware of the specific instructional treatment their child received. Analysis of questionnaire data indicated that action group parents reported more instances of verbalized environmental awareness and more overt environmental action behaviors than both the case study and control parents. Ramsey concluded that specific training in and application of environmental problem-solving skills constitute a unique instructional component which when combined with environmental information and values tends to encourage successfully independent overt environmental behavior.

Two years later, a second eighth grade teacher, Gary Klingler[3] of Nashville, Illinois replicated John Ramsey's study. His results paralleled those of Ramsey. It would seem to the authors of these modules that their teaching intuition has been verified by empirical research. The modules do work and are successful in preparing environmentally responsible students.

---

[1] Bisaga, Henry R. Middle School Students' Value Clarification in Environmental Education as a Function of Autonomous Research. Unpublished Masters thesis, Southern Illinois University at Carbondale, 1975.

[2] Ramsey, J., Hungerford, H. R., and Tomera, A. N. "The Effects of Environmental Action and Environmental Case Study Instruction on the Overt Environmental Behavior of Eighth Grade Students." The Journal of Environmental Education, 1981, 13(1), 24-29.

[3] Klingler, Gary. The Effect of an Instructional Sequence on the Environmental Action Skills of a Sample of Southern Illinois Eighth Graders. Unpublished Masters research paper, Southern Illinois University at Carbondale, 1980.

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ACKNOWLEDGEMENTS

These modules represent a radical departure from typical models for environmental education. Because of this, no definitive guidelines existed to guide the developers in the production of a curriculum that met their criteria - a program which would help middle school students become autonomous investigators of environmental problems and teach them the rudiments of environmental action strategies. This set of circumstances resulted in a development phase of nearly five years during which three editions of the modules were produced and evaluated.

A project of this type necessitates the incorporation of many skills. Many people have given both time and skills willingly in an effort to help the developers reach their goals. Trial teaching efforts by Floyd Waggoner, Larry Tate, R. Henry Bisaga, and Donna Childers contributed measurably to an evaluation of earlier editions. Equally important were the suggestions tendered by both John Disinger and Tom Tanner with respect to the action portion of this program.

J. Ronald Gardella has contributed both his artistic talents and his educational expertise as he supervised the trial teaching of an earlier edition in New Jersey middle schools. Also providing art work for Module IV was Suzanne Hungerford. Her coyote drawing is much appreciated.

Several research studies were conducted to measure the effectiveness of the modules to generate both cognitive knowledge and values. Floyd Waggoner, Henry Bisaga, John Ramsey, and Gary Klingler invested heavily in these efforts and their contributions are appreciated. William Bluhm was also involved significantly in data collection and his effort contributed greatly to the success of these research studies.

Also involved in other dimensions of the development process were Henry Frazier, Barbara Litherland, Pat Hungerford, and Suzanne Hungerford. And, when the developers were responsible for taking the modules to workshops and institutes they were assisted, at one time or another, by dedicated professionals like Gary Harvey, Rick Wilke, and Ron Gardella.

To all of the above - and many others - the authors owe a sincere debt of gratitude. Without their help these modules would not be available.

The Authors - January 1, 1985

PREFACE

To The Student

More and more students are becoming worried about problems in the environment. Perhaps you are worried because you know you are a part of the environment. Since the environment is the world YOU live in, it is very important to you. You can't get along without air to breathe. You need food to eat and water to drink. And you need clothes to wear and somewhere to live.

Maybe you have gotten the idea that this isn't enough. You think that the air and water should really be clean. The food should be safe to eat and it should taste good. The house or apartment should be a safe and happy place. Yes, maybe there even ought to be a tree close by and a squirrel to watch and an owl to listen to at night. Some students are also worried about what the environment will be like when their children are growing up. How do YOU feel about these things?

If you are worried about the future of the earth, you are not alone. Many people are alarmed about problems in the environment. Some have studied these problems. Lester Brown is one of those people. He got together a group of people to study the environment, its problems, and what can be done to help. The group is called the Worldwatch Institute. In 1984, these men and women started publishing a yearly "report card" called State of the World. The first report card gives us a scary, but honest, picture of the environment and its problems. It names soil, energy, and population as three big problems. The report also says that unless something is done, time will run out for millions of people.

The number of people on Earth is getting close to 5,000,000,000. The world population of human beings has almost doubled in the last thirty years. And that spells trouble! As the earth's population gets larger, the earth's resources get scarcer. There are fewer forests. The oceans' fish catch gets smaller. Important animals and plants are becoming extinct. Grasslands become poorer. Farm soil erodes away. What we have is a growing population (which needs more and more water, food, and shelter) and shrinking resources. There is simply less to go around. We already see many cases of crowding, severe food shortages, fuel scarcity, and poorer living conditions. Unless something is done to bring about a balance between human needs and available resources, the future is gloomy!

At this point you may be asking yourself, "Why are they telling me this?" We are not out to frighten you, but we do want you to understand just how serious the situation is. Probably the most important message for you to get is that things in the environment are not good. And they will get worse unless we do something . . . and do it soon!

What can you do? The earth's environmental problems are big ones. Sometimes it is hard to see what you can do to help in solving them. But, there are many things that you can do.

We feel that the hope for a better environment depends upon the world's citizens. Who are these citizens? You are one of them. You are both a citizen of your country and of the world. You, then, are a part of the hope for a better environment.

The authors' goal in this book is to help you become a concerned and responsible citizen. They think you are already interested in the environment and want to learn more about solving its problems. They are sure you can do it. Are you ready to begin?

MODULE I

ENVIRONMENTAL PROBLEM SOLVING

Introduction

Each one of us is a part of the environment. We are also a part of its problems. Module I should help give you a better understanding of the environment and the ways in which you interact with the environment.

In Module I you should also learn about a number of environmental problems and issues. You will be asked to learn about beliefs and values, and the part they play in creating and solving environmental issues. And you will get a chance to decide where you stand on certain issues.

Learning objectives for Module I can be found on the next page. They will tell you exactly what will be expected of you. Always read the objectives carefully before beginning work in a module.

Objectives for Module I

Upon completion of Module I you will be expected to be able to . . .

1. . . . define "environment".

2. . . . apply the term "interaction" when writing about or discussing the environment, an environmental problem, or an environmental issue.

3. . . . describe how human activities can impact on the environment.

4. . . . analyze an environmental problem and name the ways in which that problem affects both human beings and the environment.

5. . . . explain how a lessening of the quality of the environment eventually lessens the quality of human life.

6. . . . identify both environmental problems and environmental issues.

7. . . . define "beliefs".

8. . . . define "values".

9. . . . explain how a person's beliefs influence his/her position on an issue.

10. . . . explain why you consider a particular environmental situation to fit into the "issue" category.

11. . . . analyze environmental issues and identify the "players", the beliefs, and the values that are associated with that issue.

12. . . . explain why it is difficult to resolve an environmental issue when there are strong and differing value positions surrounding it.

The Environment

"Environment" is a word that you often hear. Do you know what it means? What IS the environment? In the space below, write your definition for environment. (I-1)

My definition for "environment": ________________________________

____

____

____.

Your instructor may ask several students to read their definitions. While this is being done, think carefully about these definitions. How are they alike and how are they different? Also, try to decide whether you think they are accurate. Below is a list of questions for you to think about as the definitions are read.

1. How many students identified or described things (factors) in the classroom as part of the environment?
2. How many students identified or described factors in the community or region where they live?
3. How many students said that EVERYTHING around them was a part of the environment?
4. How many students included the the ways humans affect or are affected by things around them?

One of the really important factors in an organism's environment is the INTERACTION between the organism and objects or events around it. Interactions deal with how living and nonliving things affect each other. For example, when you breathe you take oxygen out of the air. In turn, you breathe out carbon dioxide and water vapor. This is an interaction between you and the atmosphere. Plants use the sun's energy, water, and carbon dioxide to make food. In turn, they give off oxygen. This is also an interaction.

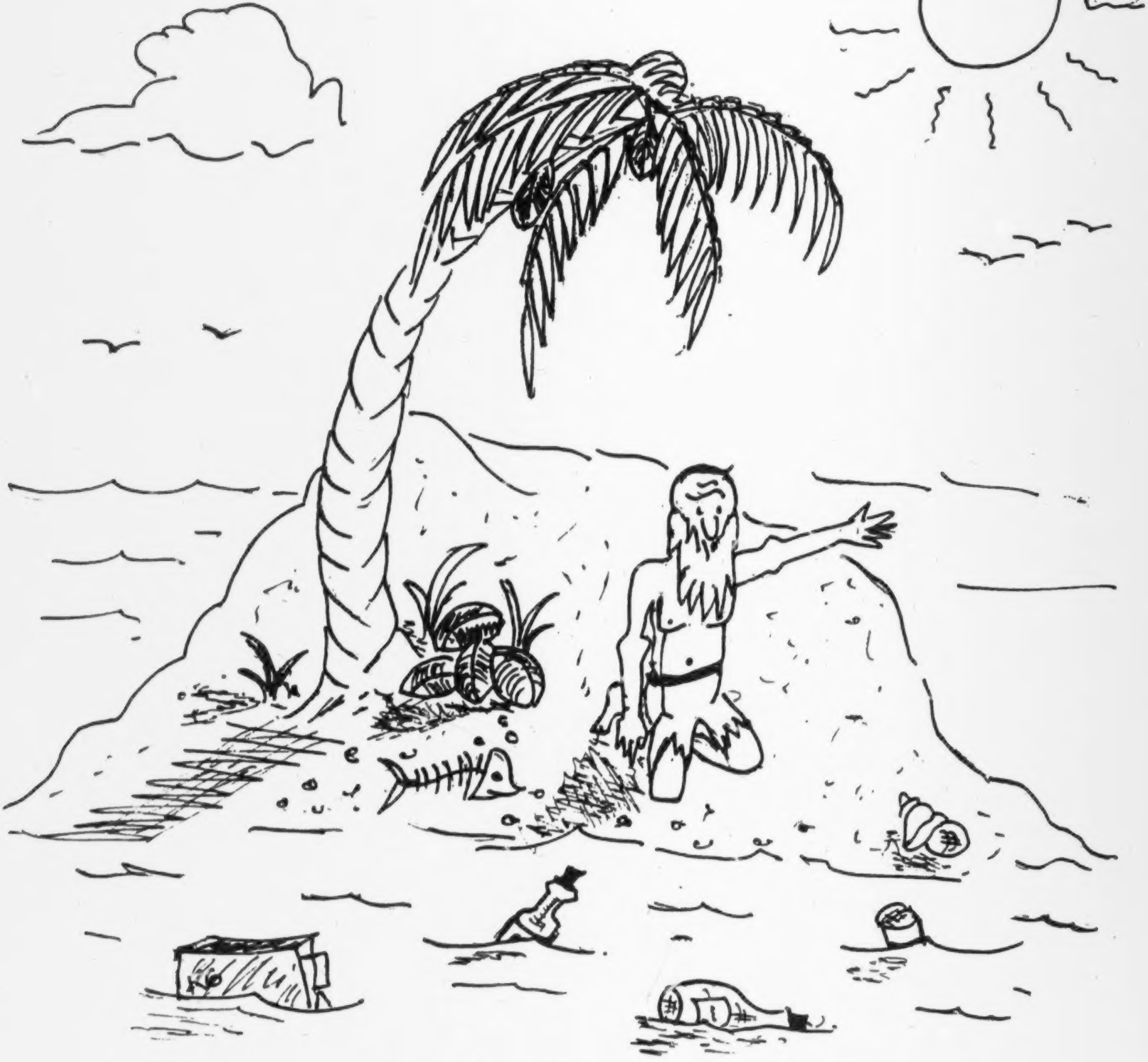
Many interactions between you and your environment are complex. Suppose you go to your favorite fast food outlet and buy a hamburger. What are the interactions between you and your environment here? First of all, an animal was killed to produce the hamburger meat for you. The animal had to be grown and processed, and all of this takes energy. The meat had to be cooked. This used up either gas or coal to produce the energy. The paper wrappings in which the food came were produced from trees. Trees had to be felled and processed. More energy! After eating the food, you put heat and carbon dioxide back into the environment. These are only some of the interactions which take place when you buy and eat that hamburger. But, you should begin to get the picture. Every time you use a resource from the environment, you interact with it. And every interaction affects both you and the environment.

It might be a good idea to take some time and look closely at a part of YOUR resource use. Hopefully, an investigation such as this will give you a better idea of how you interact with the environment.

You have seen that you interact with the environment through eating. Eating is something that we do almost every day of our lives. It gives us the energy we need to stay alive. It also usually gives us a good deal of pleasure. We can easily see how we are affected by eating. But, have you ever really stopped to think how the environment is affected? Few people have thought about this. What if you had eaten a piece of toast this morning? Let's look at a few of the environmental effects connected with that piece of toast. That may not be quite as simple as it first appears. We'll start by focusing on the slice of bread.

The bread was made from flour which came from grain. That grain was probably planted, cultivated, and harvested on a farm in the United States. Many resources were used between the farm and your breakfast table. In other words, many environmental interactions took place. The diagram on pages six and seven shows you some of those interactions - starting at the farm. Try to identify and describe as many environmental interactions as you can.

It hardly seems possible that a single piece of toast could be connected with so many environmental interactions. And yet, a slice of toast is a small part of what you eat each and every day. Think of your many interactions with the environment by the time you eat that late night snack tonight. A wise man once said, "You can never do just one thing." That certainly appears to be true. Your simple action of eating a piece of toast affects the environment in many ways!

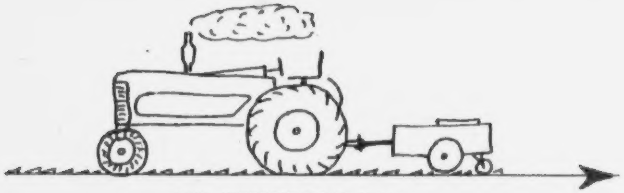


THANK HEAVEN! SIGNS OF CIVILIZATION!

THAT PIECE OF TOAST

From Wheat Field To Table

(Energy/Resource Costs)

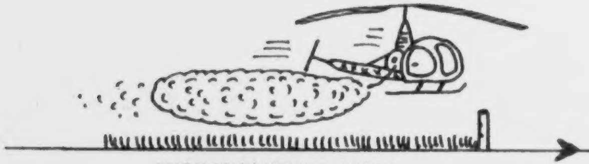


SOIL PREPARATION/PLANTING

Petroleum Products

Motor Oil
Gasoline
Diesel Fuel
Grease

(INTERACTIONS ???)

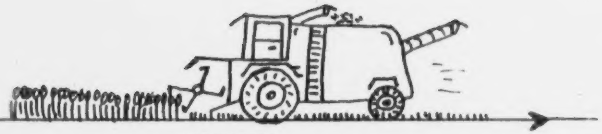


FERTILIZING/INSECT CONTROL

Petroleum Products

Aircraft Fuel
Chemical Fertilizers
Chemical Pesticides

(INTERACTIONS ???)

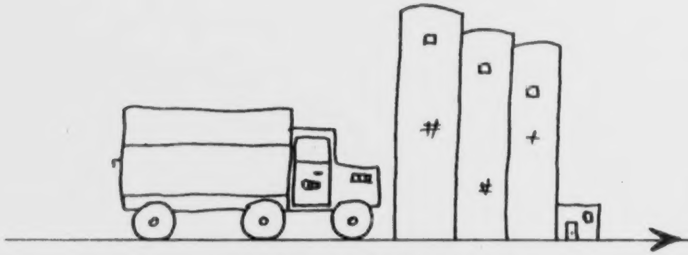


HARVESTING

Petroleum Products

Motor Oil
Gasoline
Diesel Fuel
Grease

(INTERACTIONS ???)



TRANSPORT TO ELEVATOR & STORAGE

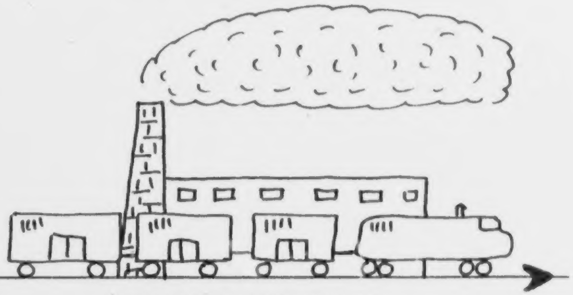
Petroleum Products

Motor Oil
Diesel Fuel
Grease

Coal or Petroleum

Electricity

(INTERACTIONS ???)



TRANSPORT TO PROCESSING MILL

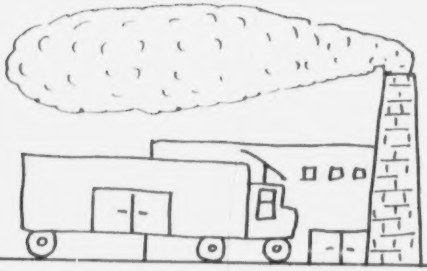
Petroleum Products

Diesel Fuel

Coal or Petroleum

Electricity

(INTERACTIONS ???)

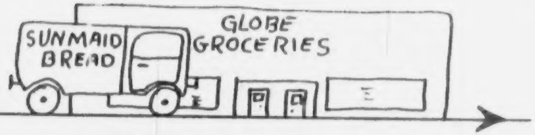


TRANSPORT TO BAKERY, BAKING, & PACKAGING

Petroleum Products

- Motor Oil
- Diesel Fuel
- Grease
- Natural Gas

(INTERACTIONS ???)


SUNMAID BREAD
GLOBE GROCERIES

TRANSPORT TO STORE/SHELVING

Petroleum Products

- Motor Oil
- Gasoline
- Grease
- Natural Gas

Coal or Petroleum

Electricity

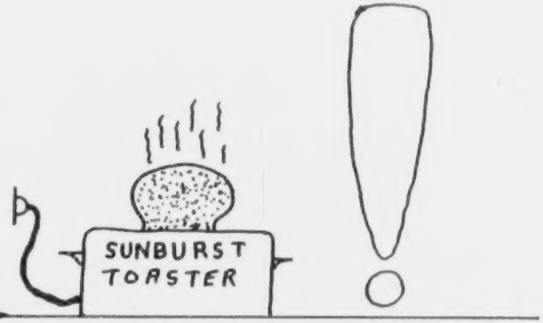
(INTERACTIONS ???)

PURCHASE & TRANSPORT HOME

Petroleum Products

- Motor Oil
- Gasoline

(INTERACTIONS ???)


SUNBURST TOASTER

TOASTING

Coal or Petroleum

Electricity

(INTERACTIONS ???)

Before you go further, it would be a good idea to think about how our actions affect the environment. Let's take that piece of toast. Just what effect did it have on the environment? (I-2)

THAT PIECE OF TOAST - ENVIRONMENTAL EFFECTS

Below, you will find a summary of some of the steps involved in the production of that piece of toast. Also, you will find a list of some of the resources consumed. Please study this summary chart and then do the things asked below:

Some Steps Involved (Benefits To Humans)	Resources Consumed
1. Cultivation of farm lands for the growing of cereal grains.	Petroleum; top soil
2. Increasing crop yields using chemical fertilizers and pesticides.	Petroleum
3. Harvesting cereal grains.	Petroleum
4. Transporting, storing, and processing the grain.	Petroleum; coal
5. Baking and packaging bread in commerical bakeries.	Petroleum; natural gas
6. Transporting and shelving bread in grocery stores.	Petroleum; coal
7. Transporting the bread to the home.	Petroleum
8. Toasting the bread.	Petroleum; coal

1. Write a list of the possible environmental effects that go along with using soil, petroleum, natural gas, and coal.

2. Write a short paragraph which tells whether or not you think these environmental impacts are important. Please explain your decision.

3. Many human beings do not realize that resource use is usually a two way street. When we are benefited by something like a piece of toast, the environment can be impacted heavily. Take a few moments to think it through and then write a short paragraph which would attempt to convince someone that human benefit and resource use is a two way street.

Summary of Environmental Interactions

We've spent a good deal of time studying how you interact with the environment. We've done so because the idea of environmental interaction is so important. In our discussion we've looked at two sides of environmental interactions. We've looked at the effects on you and the effects on the environment. It's time now to try to pull all of this together. Let's see what it all means.

We've said before that the interactions which occur between an organism and its environment are very important. We hope that two big ideas have occurred to you. The first idea is that humans interact with the environment, directly and indirectly, in many ways. We are totally dependent on our environment. Many of the "simple" things we do daily (like eating a hamburger or a piece of toast) are linked closely to the environment.

The other big idea also has to do with those interactions. Think back on the environmental interactions connected with a piece of toast. Pay special attention to the ways that using resources affects humans. Now, look at how resource use affects the environment. Are humans gaining benefits from those interactions? What about the environment? Is the environment gaining benefits from those interactions?

Many of the environmental interactions that make our lives more comfortable tend to degrade or harm the environment. Often, improving the quality of human living results in lessening the quality of the environment. Many people are concerned about this imbalance. They desire a comfortable living for themselves. At the same time, they desire a clean and healthy environment. Some people argue that the quality of life and the quality of the environment are not at all separate, but are closely linked. They even suggest that lessening the quality of the environment will eventually lessen the quality of our lives. They say it will also threaten the lives of future generations. Think about this for a minute. Why might it be true? (I-3)

Why might this be true? ______________________________

____

____

____

Environmental interactions are much more complex than they first appear. Understanding this idea is an important step to understanding what "environment" means. So, let's come back to that question. Just what is meant by "environment"? We think that your ideas about "environment" might have changed since we first asked that question. We'd like you to write a definition or description of "environment" on a separate sheet of paper. This could be turned in to your instructor. That way, he or she can see how well you understand this term. Afterward, your teacher may ask your help in putting together a class definition. That definition can be posted in the classroom as a permanent reference. (I-4)

Environmental Problems

By now, you have an idea about what the environment includes. We'd like you to start thinking about ideas connected with environmental problems and issues. First of all, can you name several problems in the environment? We've listed three for you. Try to name four more. If you are still having trouble after a few minutes, talk with your teacher. For now, ignore the column marked "Issue". We'll come back to that later. (I-5)

My List of Environmental Problems

Example: Soil erosion due to poor farming practices.
Example: Declining duck populations due to the drainage of wetlands.
Example: Air pollution from coal-burning electrical power plants.

My Choice for a Problem	Issue
1. ______________________________	_____
______________________________.	
2. ______________________________	_____
______________________________.	
3. ______________________________	_____
______________________________.	
4. ______________________________	_____
______________________________.	

How did you decide what to list as an environmental problem? It might help you to know that environmental problems are related to man, the environment, and interactions between the two. An environmental problem also presents a difficulty of some sort. For example, a volcano erupting, an earthquake, and a flood are all natural events. These events are not considered to be environmental problems. But what if the volcanic eruption, the earthquake, or the flood threatened some part of man's physical or economic well-being? What if it lessened his quality of life in some way? Then we might say that the event resulted in an environmental problem.

How might an event threaten human well-being or lessen the quality of life? Perhaps a volcanic eruption might change atmospheric conditions and weather patterns. Maybe the flood could destroy human lives and homes. Or perhaps an earthquake could cause buildings to collapse and water and gas pipes to break. All of these could be considered to be environmental problems.

Let's see how a specific event resulted in a number of environmental problems. The event we'll look at is the eruption of Mount St. Helens. Mount St. Helens is a volcano located in the state of Washington. For years, the volcano was inactive. People built their homes near its slopes. Wildlife was abundant and wilderness areas were set aside for preservation and recreation. Lumbering companies studied the possibilities of cutting trees from its slopes. Suddenly, Mount St. Helens rumbled to life in 1980.

Following the Mount St. Helens eruption, a number of environmental problems were obvious:

1. Many animals, including large numbers of elk, were killed.
2. Hundreds of acres of timber were levelled by the blast.
3. Volcanic ash deposits disrupted activity in urban and agricultural settings.
4. Human life was lost.
5. Areas used for recreation were considered dangerous and were closed to the public.
6. There were changes in stream flow and drainage patterns.

All of the above could be considered environmental problems. They involved man, the environment, and interactions between the two. They also threatened some aspect of human well-being.

Mount St. Helens eruption. Photo courtesy U. S. Geological Survey.

Environmental Issues - Beyond Problems

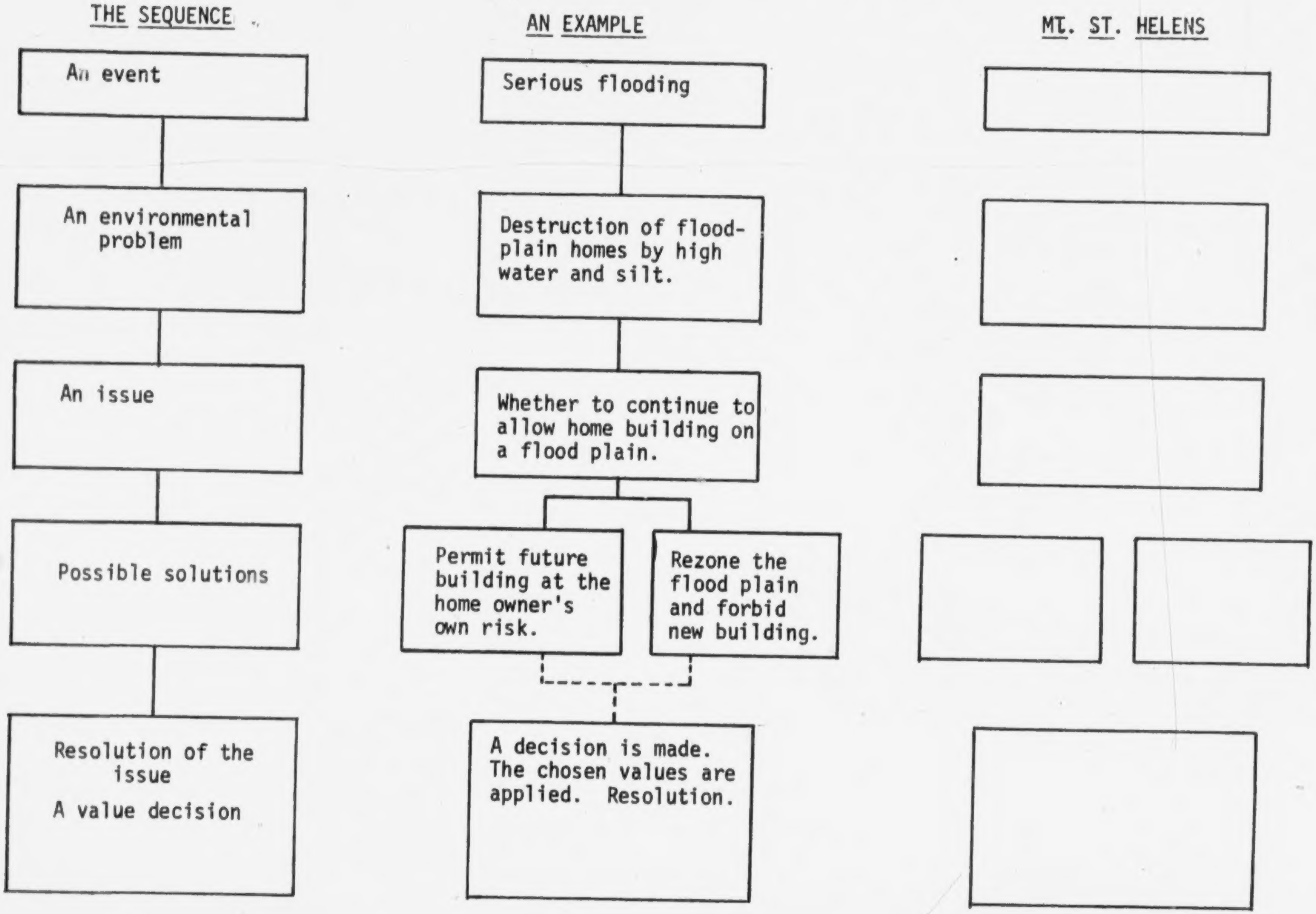
Now that you know what an environmental problem is, let's look at issues. An issue is a matter about which two or more parties can't agree. In many cases, environmental problems remained unsolved because people (or groups of people) can't agree on how to solve the problem. We usually call these disagreements environmental issues. Such a disagreement occurred between lumber companies and a group of citizens after the eruption of Mount St. Helens.

The force of the Mount St. Helens eruption blew down hundreds of acres of timber. These companies believed that the timber was going to waste. They also felt that it would be profitable to collect and process the fallen trees. A group of citizens disagreed. They argued that the trees should be left on the ground. They believed that the decaying timber would provide nutrients to the area. That way the area would restore itself much sooner than if the trees were removed.

Both of these groups were aware of the environmental problem . . . that there were hundreds of acres of fallen timber because of the eruption. But they disagreed over what should be done with those trees. Thus, they disagreed over the solution to the problem. The lumber companies and the citizen groups held different points of view regarding the fallen trees. When a person has a point of view about something, we call that his or her position. People may take different positions on environmental issues. And their positions will probably differ because they represent different beliefs and values. These beliefs and values will influence the solutions that people choose.

The diagram on page 15 shows how natural events might lead to environmental problems, which in turn can lead to environmental issues. Study the sequence leading from the event to an issue and finally to a resolution of the issue. Then try to complete a similar sequence using the eruption of Mount St. Helens as the natural event which starts the sequence. (I-6)

HOW TO LOOK AT ENVIRONMENTAL EVENTS, PROBLEMS, & ISSUES



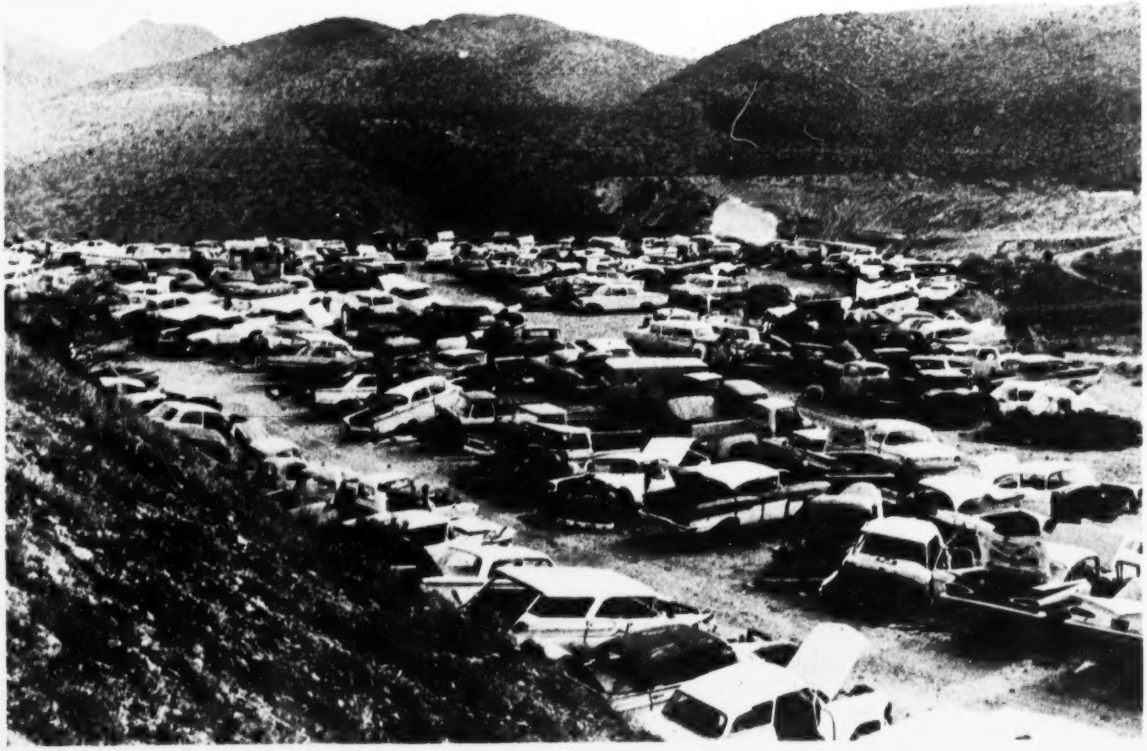
THE SEQUENCE	AN EXAMPLE	MT. ST. HELENS
An event	Serious flooding	
An environmental problem	Destruction of flood-plain homes by high water and silt.	
An issue	Whether to continue to allow home building on a flood plain.	
Possible solutions	Permit future building at the home owner's own risk. Rezone the flood plain and forbid new building.	
Resolution of the issue A value decision	A decision is made. The chosen values are applied. Resolution.	

Illegal Dump in an Abandoned Strip Mine. (Photo courtesy H. R. Hungerford)

Many serious environmental issues are seen in this photo. New strip mine legislation guarantees that scenes like this will not be common. However, abandoned strip mines still scar the landscape in coal producing regions. It is also tragic that many people believe that these areas are public garbage dumps. This illegal dump is not only unsightly, it also helps make the water unsafe for any use. An immense amount of metal rests here in the damp Midwestern air - metal that could be recycled and used again. A few years ago the trash heap of the United States - for just one year - included the following:

Cans:	17,000,000,000
Jars and Bottles:	38,000,000,000
Tons of Plastic:	4,000,000
Television Sets:	7,600,000
Cars and Trucks:	7,000,000
Tons of Paper:	35,000,000

What is the waste situation in YOUR community? Are there any environmental problems associated with waste disposal there? Is any of the waste recycled? If not, why not? Investigate the situation and find out.



Automobile Graveyard in Arizona. (Photo courtesy H. R. Hungerford)

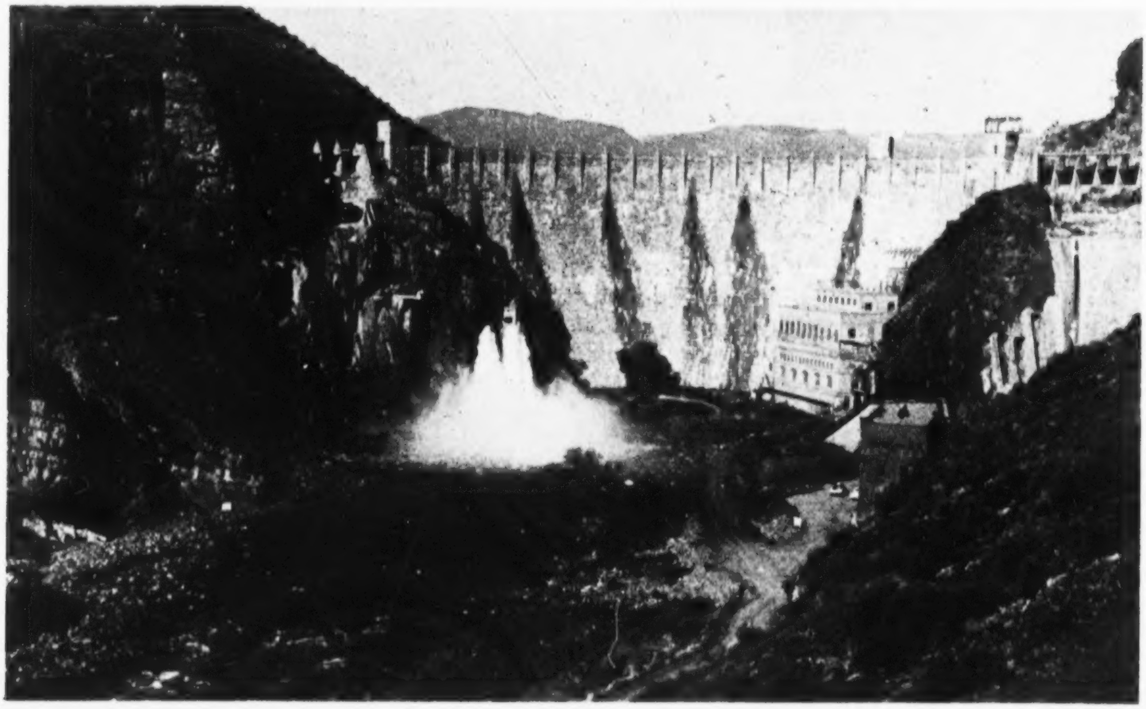
Few, if any regions in the U.S.A. are without their auto graveyards. Not only are junked and abandoned cars an ugly sight, they also take up space on the planet that could be used more wisely. Perhaps of greater concern is the fact that these autos, vans, and trucks represent a tremendous resource in steel that could be recycled. The U. S. has well over 600,000,000 tons of discarded iron and steel rusting on the ground right now. Recycling could provide enough material to meet the U.S. demand for over a decade. For each ton of scrap steel and iron that is recycled, 1.5 tons of iron ore and 700 pounds of coal are SAVED.

How many junked cars and trucks show up in fields and vacant lots where YOU live? Are old autos recycled in your region? If not, why not? Investigate and find out!

Flooded Homes on the Des Plaines River in Illinois. (Photo courtesy H. R. Hungerford)

Wise planning and land management could have prevented this costly tragedy. Flood plains should not be used for housing or industrial development. To prevent further damage to these homes, the river might be dammed or channelized (deepened). However, these actions often create more complex environmental problems. They produce more floods downstream, increase sedimentation and erosion, and eliminate many kinds of wildlife. How should flood plains be used by man? How can concerned citizens convince people that misuse of flood plains creates environmental problems? Do land use problems similar to this exist in your area. If so, why?

MARION



Midwestern Coal Strip Mine. (Photo courtesy H. R. Hungerford)

In the United States, hundreds of millions of tons of usable coal lie between 50 and 100 feet beneath the surface of the land. These coal reserves are available to surface or strip mining. In this scene you can see the huge stripping shovel that removes the soil and rock from above the coal. In the background can be seen the small shovel used to remove the coal itself. In strip mining, the surface of the land is changed a great deal. Even with strict reclamation practices much of the land may never be as productive as it once was. However, with the demand for coal high, more and more land will be mined in this way. An area twice the size of the state of Delaware has already been stripped. Even though more and more mining laws are passed, environmental problems remain. Try to list some of the possible issues associated with strip mining.

Roosevelt Dam in Arizona. (Photo courtesy H. R. Hungerford)

Few issues raise as many questions as does the damming of streams and rivers. There are many who are violently against damming natural waterways. There are also those who are very much in agreement with this practice. On one hand, dams can be used for water storage, flood control, and the generation of electricity. Also,certain kinds of recreation are promoted by the lake that forms behind the dam. On the other hand, hydroelectric power provides only a limited amount of electricity in the United States. And, where a dam is built, the flow of the stream is sharply affected. Many plant and animal species are harmed. Also, in time, silt will fill the reservoir behind the dam, destroying the lake and its recreational value.

Aerial Photo of Chicago, Illinois. (Photo courtesy H. R. Hungerford)

Well over 1000 square miles of land along the southern tip of Lake Michigan is covered by residential, business, and industrial developments similar to this portion of Chicago. The use of the land, air, and water by so many people creates many environmental problems. For example, what do you think causes the haze in the air even on such a clear day as this? Would you consider this haze to be an environmental problem?

This city may seem to be largely independent. Yet, it must be provided with food, electrical energy, water, and a waste disposal system. What environmental problems can you think of that might be caused by taking care of these needs? What effects on the behavior of people do you think living and working in this metropolitan area might have? Could crime be a serious problem? Would you consider crime to be an environmental problem? Why? Why not?

Intersecting Superhighways Near Chicago. (Photo courtesy H. R. Hungerford)

Many environmental problems could be posed from this picture. Most of them concern land use. This scene represents a typical "urban sprawl". Notice the clustered neighborhoods and large open spaces between. Does this development pattern make the most efficient use of space? What problems can you identify that could arise concerning the use of the automobile, supplying utilities, and land values? Many people build homes in such an area because the highways provide fast, easy access to the city. As more and more subdivisions are developed along the highways, what will be the effect on agriculture?

Can you identify similar environmental problems in your own area. You don't have to live in or near a large city to see them. Does your area have an agency responsible for planning the use of land for both housing and commercial developments? What are its policies? Are they environmentally sound?

Beliefs and Values

When we speak of beliefs and values, we're getting to the heart of the matter. People may take different positions on the solutions to environmental issues. The position a person takes usually depends upon his or her beliefs and values. A belief is an idea which a person holds to be true. The idea may or may not be true, but the person believes it is.

In many cases, a person's beliefs are strongly tied to his or her values. A value is the worth which a person (or group of people) places on something. Usually, our values guide us in the choices we make.

Understanding beliefs and values is important in understanding just what an environmental issue is all about. You might say that there are two things which make an environmental issue what it is:

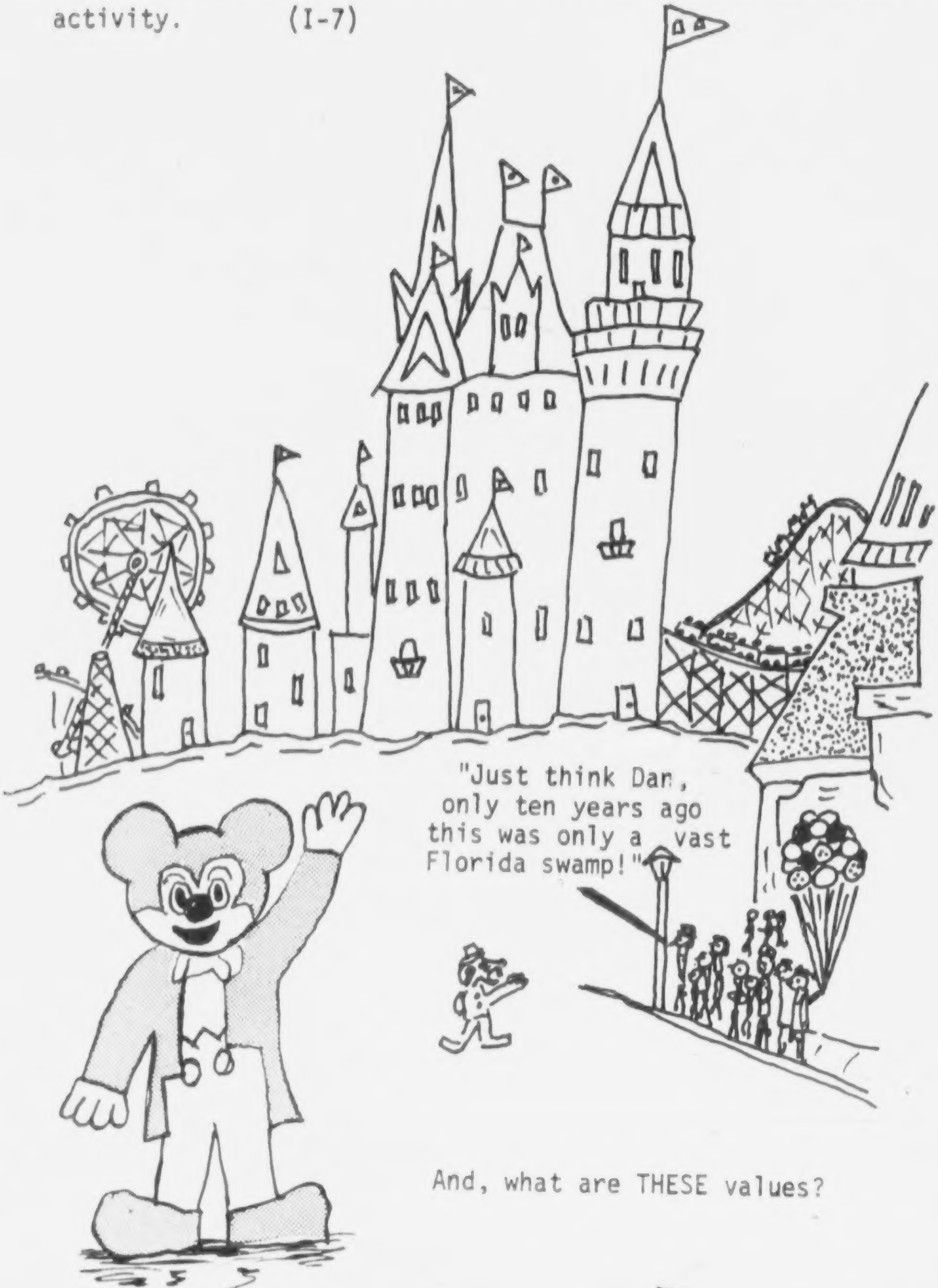
1. It includes man, the environment and interactions between the two, and
2. It involves differing human beliefs and values which lead to differing positions regarding the solution to the issue.

When people differ on their beliefs and values, they usually disagree on how an environmental issue should be solved. They have differing positions regarding the solution to the issue.

It is helpful for a person to be aware of his or her beliefs and values. This is so because conflicts sometimes arise within a person. Sometimes a person feels like he or she is caught between two values. The choice may not be between a "good" and a "bad", but rather between two "goods".

You can probably think of examples of value conflicts within your own classroom. For instance, cheating on tests is frowned upon. Many students think highly of themselves. They value their own honesty and wouldn't think of cheating. But, suppose you believed that the test was very important? Perhaps it was one which would decide your career, or would determine whether or not you could go to college. And suppose your parents were really counting on you to do well on the test. Then your decision on how to act might be more difficult. You might value your own honesty. But that value might conflict with your value for "getting ahead", or for furthering your education, or for pleasing your parents.

Belief and value conflicts can also arise within a person when it comes to environmental issues. In order to understand and test our beliefs and values, it is helpful to look at them and discuss them with others. We're going to leave the Mount St. Helens issue for a while and give you a chance to examine some of your ideas about several environmental issues. You will have an opportunity to share your beliefs about these issues with your classmates. You will also be able to talk about WHY you feel the way you do and just what it is that you value. Some of your ideas may change slightly as a result of your discussion. Of course, you may also feel even more strongly about an idea after the discussion. We think you'll enjoy this activity. (I-7)


"Just think Dan, only ten years ago this was only a vast Florida swamp!"

And, what are THESE values?

Environmental Beliefs and Values - Where Do You Stand?

Directions: This activity is designed to let you compare a few of your environmental beliefs and values with those of your classmates. Below you will find a list of six belief statements with which you may agree or disagree. Following each is a response line ranging from "strongly disagree" to "strongly agree". Please circle the response which best reflects how you feel about the statement.

1. The killing of deer by hunters plays an important part in keeping deer herds healthy.

X	X	X	X	X
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. Human females should not have more than two children.

X	X	X	X	X
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. The recycling of metals such as aluminum should be mandatory even if it is not always profitable.

X	X	X	X	X
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. Air pollution standards should be relaxed in order to get better gas mileage in automobiles.

X	X	X	X	X
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. Only those people who live alone or have special problems should be allowed to keep a dog or cat because of the tremendous amount of food energy consumed by pets.

X	X	X	X	X
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. We should continue to build nuclear power plants in order to produce needed electrical energy.

X	X	X	X	X
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Next, we'd like you to summarize your responses. After everyone in class has completed his or her responses, fill in the summary chart below. Add up the class responses in each category for each statement.

Summary Chart

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.				
2.				
3.				
4.				
5.				
6.				

Discussion Questions:

1. Analyze those statements for which there are wide differences of opinion. Why do these differences exist? Are the beliefs and values expressed ecologically sound? Why? Why not?

2. Sometimes a group will tend to load on the "neutral" category. When this occurs, what might be the reason? Could this circumstance be changed through more information? If so, how?

3. Why is it difficult to resolve an environmental issue where there are strong and differing value positions?

Analyzing an Environmental Issue - Mount St. Helens

You've just spent some time examining your own values and beliefs. Now, let's look at the beliefs and values involved in another environmental issue. Identifying those beliefs and values is a part of analyzing the issue. It can enable us to have a better idea about what is involved in the issue.

Remember the disagreement over the fallen timber after the Mount St. Helens eruption? It shouldn't surprise you that there were also other environmental issues. One of them had to do with how the area should be used after the eruption. Below you will find some more information about this issue. Read through it carefully. See if you can identify the differing positions in this issue.

> The effort to protect Mount St. Helens in Washington state's Cascade Mountains began many decades ago. The volcano's snow-covered cone, rising above a dark necklace of forest and reflected in Spirit Lake, was one of the most pictured scenic views in America. Over the years there have been various attempts to have a part of the mountain's slopes set aside as a national park or wilderness area. The lands were already owned by the federal government as national forest, but there has been continuing pressure on the Forest Service to allow clear-cutting to encroach closer and closer to the most prized scenic areas. A group of concerned citizens, calling themselves the Mount St. Helens Protective Association, consistently fought for some kind of special congressional protection.
>
> Then came the 1980 eruption. The protective association decided that the volcano's wilderness recreation values were as strong as ever. The picture-postcard perfection of the Spirit Lake view is gone, but the mountain's wild beauty and remaining virgin forest are still awe-inspiring. And there is an added educational value for the general public - particularly for scientists: a unique opportunity to observe the Mount St. Helens area as a natural monument. The timber industry came on with a public relations campaign, demanding immediate salvage of the timber blown down by the eruption's blast. The association gave the press an answer: 'A large part of the land we propose to protect is timber-less mud-flows or ash deposits, and most of the timber in the rest of the area is either low quality, inaccessible, or both.' (Adapted from Audubon Action, February, 1983)

Before you can deal with issues like the one just described, you must be able to analyze them. Analyzing issues involves recognizing who is involved in the issue, the positions those people take, and the beliefs and values they hold.

You might look at the people involved in the issue as the "players". Recognizing the players and their positions is usually not too hard. In the Mount St. Helens issue, the lumber industry wanted to go into the national forest and salvage the fallen timber. The Protective Association wanted the area set aside as a natural monument. Preserving the area in this way would prevent any future lumbering. What were the beliefs and values behind each of these players and their positions?

If you answered that the lumbering industry was operating on economic values, you are probably correct. The lumber companies were in the business of making money. The fallen trees looked like a ready and profitable resource.

You might also say that the Protective Association's position showed more than one value. The group referred to the beautiful and awe-inspiring nature of the area. This suggests aesthetic values. Aesthetic values have to do with a sense of beauty. The group also spoke of the recreational and educational values of the Mount St. Helens area.

We are not here to suggest that one set of values is better than another. But we hope that you've gotten the idea that different values are involved in the issue. Picking out the players, the positions, and the beliefs and values are all part of analyzing an issue. Below is a chart to summarize the analysis of the Mount St. Helens issue. We have filled in the players involved in the issue and the positions which they took. See if you can identify the beliefs and values that were behind their positions. (I-8)

Issue Analysis: Use of Mount St. Helens Area

The Players: Their Positions	Beliefs:	Values:
Lumber Industry: We should be allowed to enter the area and salvage the downed timber.		
Mount St. Helens Protective Association: We should set aside the area as a natural monument. Allow no lumbering activity .		

Issue Analysis - Burning High-Sulfur Coal

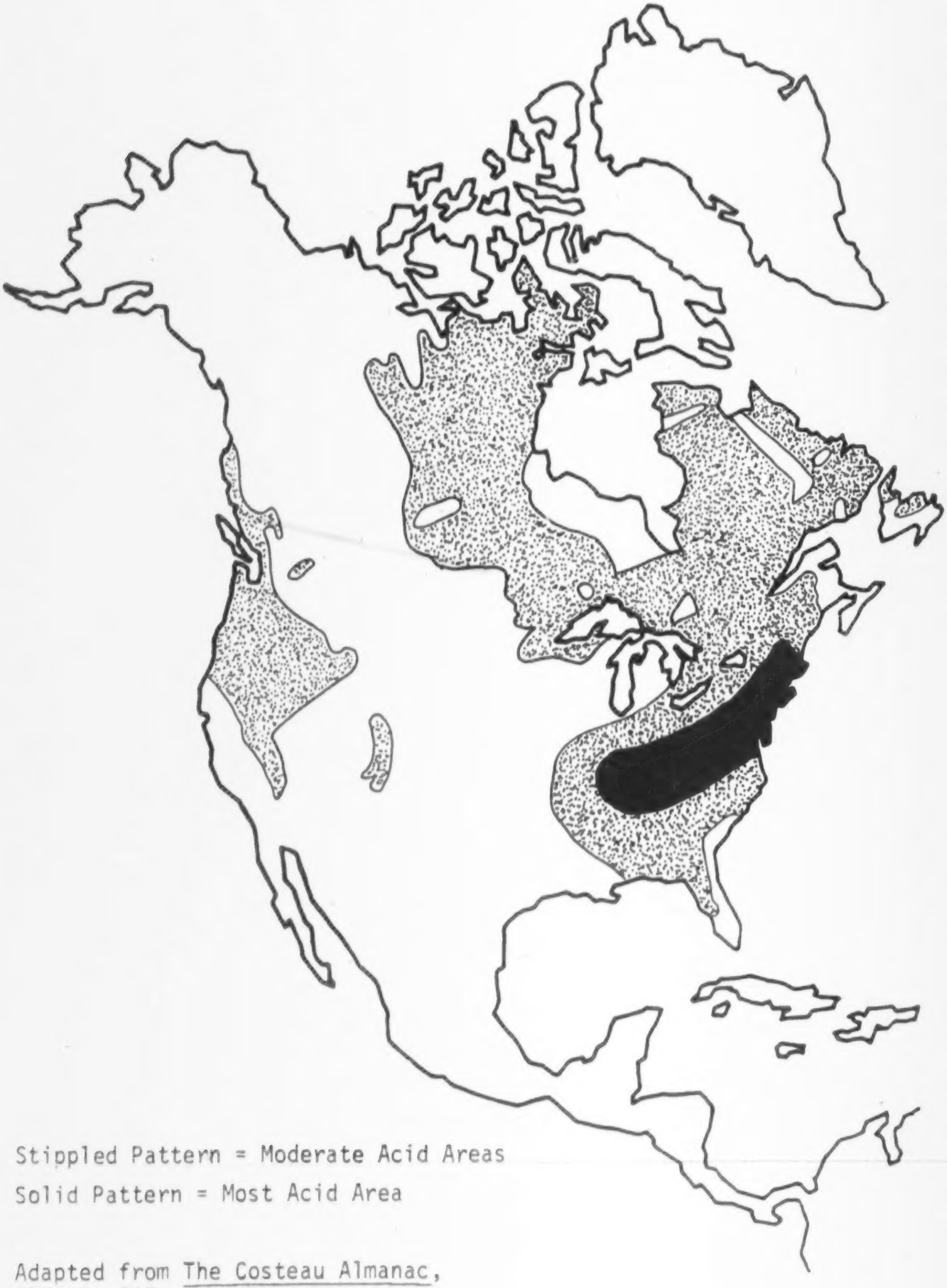
We'd like you to try your hand at analyzing another environmental issue. The issue we will look at involves burning high-sulfur coal in order to generate electricity. This issue is probably a little more complex than the Mount St. Helens issue. The burning of high-sulfur coal and the acid rain associated with this practice appear to be the cause of environmental problems in countries around the world. For this issue analysis, we'll focus on the problems in North America.

A number of people in the northeastern United States and in Canada are concerned about this issue. There are many lakes, forests, and natural areas in this region. Because of this, large numbers of tourists visit the region each year and enjoy its natural beauty. In the past several years, there have been reports of dying forests. In many places, rivers and streams are no longer able to support plant and animal life. Many people in the region value a healthy environment. They are alarmed at what is happening. They also value the benefits that the tourist trade brings to the region. Many of their jobs depend upon a healthy environment to attract tourists.

Some of the people in the Northeast and in Canada believe that acid rain is to blame for what is happening. Scientists suggest that acid rain may be caused by burning high-sulfur coal. This may be so, even if the coal is burned in other parts of the country. When coal is burned, the smoke is carried high into the atmosphere. If there is sulfur in the smoke, it can mix with the moisture in the air and fall to the earth as acid rain. The acid water changes the conditions of lakes and streams so that plants and animals can't survive there. It also harms trees. Power plants burn a great deal of coal to produce electricity. Some people argue that only low-sulfur coal should be burned. Others say that it's okay to burn high-sulfur coal if "scrubbers" are used. Scrubbers are devices that can be installed in smokestacks. They remove pollutants, including sulfur, from smoke before it is released into the air.

The power companies disagree. They either do not believe that high-sulfur coal is to blame for acid rain or they do not want to admit that they agree. They argue that scientists have not proven that sulfur fumes cause acid rain. They also believe that the damage to forests and lakes in the Northeast may not be due to acid rain. Finally, they say that the scrubbers

Extent of Acid Rainfall in North America



Stippled Pattern = Moderate Acid Areas

Solid Pattern = Most Acid Area

Adapted from The Costeau Almanac, 1981, p 187.

which could clean up the coal smoke should not be required. They are too costly and electricity customers would have to pay higher rates. They are sure their customers do not want this.

It should not surprise you that coal miners are also interested in this issue. Coal from many parts of the United States is high in sulfur content. If only low-sulfur coal was burned, many coal miners would be out of work. This would be a great hardship for these people and their families.

There are many more players and positions in this issue than those mentioned above. But we think that you've probably gotten the idea as to how complex an environmental issue can be. Now, we would like you to analyze this issue. You will notice that we have already named the players for you. Can you fill in the positions which these players take? What about their beliefs . . . and the values connected with those beliefs? Let's see how well you can do this. (I-9)

Issue Analysis: Burning High-Sulfur Coal

The Players: Their Positions	Beliefs	Values
Residents of northeastern U.S. and Canada:		
Power Company Officials:		
Coal Miners:		

You can see that environmental issues can be very complex. Many different beliefs and values are involved. And those differing beliefs and values are precisely why people cannot agree on how environmental problems should be solved.

Summarizing Environmental Issues:

Now that you've come this far, you should know a great deal more about environmental issues. We would like you to look back at the four environmental problems which you listed on page 11. How many of those are environmental issues? Take your time in making your decisions. Your instructor may want you to discuss this with your classmates. Whenever you decide that one of the problems is also an environmental issue, put a check in the column marked "Issue". (I-10)

We would like for you to do one more thing with the list of issues you came up with. Choose any two of the issues and tell WHY they are issues. Write your reasons below. Just write down your own ideas about why these might be considered issues. Do not worry right now about whether your ideas are 100% accurate. (I-11)

Why Are They Issues?

Chosen Issue: ______________________________

Why this is an issue: ______________________________

____

____

____

Chosen Issue: ______________________________

Why this is an issue: ______________________________

____

____

Now, look back over your two issues and over the reasons you gave for them being issues. Check for two things. First, an environmental issue involves man, the environment, and interactions between the two. Do your issues include these three things? Second, your reasons should show that people have different beliefs and/or values about the solutions for the issue. Check your reasons to see if they show conflicts in beliefs and/or values.

Alright, where are we now? We've been studying environmental issues. We have also talked about beliefs and values. This all started when you were asked if you knew what environmental problems were. You've gone past the idea of environmental problems. You have also tackled the idea of environmental issues. How well do you think you can define or describe what an environmental issue is? Write out your definition below. Be sure to keep in mind the things you've worked on so far. Again, your instructor might ask you and your classmates to come up with a definition of "environmental issue" which can be posted in your classroom. (I-12)

My definition of "environmental issue": ______________________________

____

____

____

____

____

____

____

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

MODULE I

ENVIRONMENTAL PROBLEM SOLVING

Objectives for Module I

Overview:

In Module I, the students begin by defining the term environment and discuss the concept of environmental interactions. They then analyze a set of environmental interactions in terms of human impact on the environment and discuss the relationships between the quality of human life and the quality of the environment. With this basis in hand, they turn to a definition and identification of environmental problems. They then analyze one problem in terms of the issues which arise from that problem. Subsequent experience is given in identifying the differing positions, beliefs and values which are inherent in specific environmental issues. Finally, students apply their knowledge of environmental issues, beliefs and values to problems of their own choosing.

Specific Objectives: As a function of Module I, students will be expected to be able to . . .

1. . . .define "environment".

2. . . .apply the term "interaction" when writing about or discussing the environment, an environmental problem, or an environmental issue.

3. . . .describe how human activities can impact on the environment.

4. . . .analyze an environmental problem and name the ways in which that problem affects both human beings and the environment.

5. . . .explain how a lessening of the quality of the environment eventually lessens the quality of human life.

6. . . .identify both environmental problems and environmental issues.

7. . . .define "beliefs".

8. . . .define "values".

9. . . .explain how a person's beliefs influence his/her position on an issue.

10. . . .explain why you consider a particular environmental situation to fit into the "issue" category.

11. . . .analyze environmental issues and identify the "players", the beliefs, and the values that are associated with that issue.

12. . . .explain why it is difficult to resolve an environmental issue when there are strong and differing value positions surrounding it.

SUGGESTIONS FOR TEACHING MODULE I

Research tells us that students learn, for the most part, what they perceive we want them to learn. This very observation tends to reaffirm one of the main benefits of the behavioral teaching model. Module I (and subsequent modules) incorporates a set of performance objectives for students. It is strongly recommended that the teacher go over these objectives with the students prior to the initiation of the unit plus the major objectives of all units, i.e., the development of a skilled autonomous learner. This major objective should be communicated in a manner that is intended to generate a feeling of worth and ability on the part of the student. This strategy reflects positive reinforcement, one of the most important tools available to an instructor at any grade level.

In EXERCISE I-1 (page 3-SM) students begin their study by defining the term "environment". The classic definition of this term normally incorporates all variables in the surroundings which influence a living organism. Students tend to focus their initial responses on factors which exist in their environments. This is a good place to begin but it is an extremely narrow perspective on the environment. The intent of the prose which follows this preliminary exercise is to bring the student to the realization that "environment" goes far beyond those factors that influence the student directly. The writers would prefer to have the students gain a concept of environment that goes even beyond those influences that impinge on living things per se. The rationale here is that all non-living (abiotic) objects also have "environments". Further, interactions can take place between abiotic conditions that do not directly influence living things. An example would be the interaction between crustal pressures and movements of rocks in the earth's crust. Another would be those reactions that take place between the atmosphere and sulfur compounds (given that no subsequent biotic influences occurred). A comprehensive concept of the term "environment" will have implications for further work in dealing with environmental problems and, therefore, it should be taken beyond the realm of the individual and living things per se. Of couse, any reference to environmental factors outside the realm of the individual himself must be thought of as actually being a part of the student's own environment - even though they may not influence the student directly.

Later in this module, in EXERCISE I-4 (page 11-SM) the students are asked to prepare a definition on which all can agree - a definition of "environment" that can serve as a model throughout the entire program. An example might be: The environment is made up of all objects and events in the universe plus all of the interactions taking place between those objects and/or events.

EXERCISE I-2, (pages 8 and 9-SM) involves the students in an analysis of the effects of their actions on the environment. The materials on pages 3-8-SM have presented the students with an example of the many interactions inherent in the preparation of a simple piece of breakfast toast. The diagram on pages 6 and 7 traces those interactions from the wheat field to the table. The instructor may wish to have the students examine each step in the diagram and discuss resource use and environmental impacts of each step. Also, the 12 minute film, Toast, traces the energy intensive processes used in food production and distribution. This visual is available for purchase or rental in both 16mm and videocassette formats from:

Bullfrog Films
Oley, PA 19547
(phone 215-779-8226)

Students are next given a table which summarizes both the human benefits and the natural resources utilized to deliver those benefits. Students are then asked to examine the table and . . .

1. identify the possible enivronmental effects of using soil, petroleum, natural gas and coal.

2. decide on the importance of these effects.

3. defend the idea that human benefit and resource use is a two way street.

The instructor may wish to hold a general class discussion on the student responses.

Some of the effects of natural resource use (Task 1) include: depletion of soil nutrients, possible loss of soil through erosion, acidic runoff from abandoned strip mines, depletion of the finite supply of fuel reserves, depletion of natural compounds used to manufacture pesticides and fertilizers, damage to marine life from oil slicks, possible air pollution, acid rain contamination from high sulfur coal-fired power plants, damage to tundra by oil pipelines, etc. The importance of all of these possible effects cannot be underestimated.

If students are unable to generate reasons for the importance of such effects (Task 2), the instructor may wish to point out some or all of the following ideas:

1. A finite supply of natural energy sources is being depleted for human desires which are conveniences rather than necessities.

2. Indiscriminate human use of energy resources can often lead to polluting other natural resources such as air, water and soil.

3. Indiscriminate human use of energy resources may damage natural ecosystems (e.g. oil slicks; tundra damage from oil pipeline, off-shore drilling).

The third task in this exercise requires the students to think about the balance between human resource use and human benefit (the balance of the quality of life and the quality of the environment). Student responses will vary. It is hoped that the student will begin to realize, that in general, humans take a consumptive or utilitarian view of the natural environment rather than a perspective of husbandry of the planet. Humans tend to take from the environment that which they want rather than only what they need. Our indiscriminate use of the natural environment carries with it severe impacts (some irreversible) on our sole source of supply. In turn, if and when humans return "resources" to the environment, they are in the form of solid or liquid wastes, some of which are toxic to humans and natural ecosystems as well. Often, this waste is in a non-reusable form since it cannot readily decompose or chemically disintegrate and, therefore, cannot enter the natural material cycles of the ecosystem (biogeochemical cycles).

EXERCISE I-3, (page 10-SM) further extends the idea of the balance between human life quality and quality of the environment. By responding to this task, it is hoped that students begin to understand that the fate of humanity as a species is inexorably tied to the fate of the environment. It has been the authors' experience that middle and junior high school students are quite capable of intellectually handling the idea of ethical responsibilities to future generations. A teacher posed question such as "Is it all right for humans to take whatever they want to have a good life ... or should they think of those who will come after them?" can elicit varied responses and precipitate a valuable class discussion. If the students do not generate the idea, the teacher may want to discuss the growing numbers of illnesses and diseases which may be linked to air pollution, toxic wastes, asbestos use, etc. In these cases, human health appears to be directly linked to environmental quality. Some students may identify the personal, psychological, and aesthetic benefits humans derive from spending time in pristine natural environments. Although it is impossible to price this benefit, its value to the human spirit cannot be underestimated. If resource use threatens the survival of such natural areas, it may well be regarded as a threat to human well-being.

EXERCISE I-5, (page 11-SM) asks the students to list four environmental problems. Students should not have difficulty listing this number. However, the instructor should monitor the manner in which the environmental problems are stated, being certain that the problems also name the problem source, e.g., not "soil erosion" but "soil erosion due to poor farming practices," or "...overgrazing of pasture land", or "...deforestation." It is important that the environmental problem be identified completely in that it initially delimits the problem, and distinguishes it from all other problems. This delimitation assists in further analysis and research on the problem.

EXERCISE I-6, (pages 14-16-SM) requires the students to consider the sequence leading from a natural event to an issue and its resolution. This exercise is the culmination of the prosaic information presented on pages 12-14-SM which uses the Mt. St. Helens volcanic eruption and the problems and issues which emanated from this event as an example. The student manual provides limited information on the 1980 eruption of Mt. St. Helens. An excellent source of more information can be found in the January, 1981 issue of National Geographic (Vol. 159, #1).

In the exercise the student is asked to apply the sequence starting with the eruption of Mt. St. Helens as the event. A number of problems and issues have resulted from this event and, therefore, a number of sequences are possible. The sequence example which follows on the next page uses the fallen timber problem.

PROBLEM - ISSUE SEQUENCE

EVENT	-	Eruption of Mount St. Helens
ENVIRONMENTAL PROBLEMS	-	Acres of timber flattened by the eruption
ISSUE	-	What should be done with fallen timber?
POSSIBLE SOLUTIONS	-	1) Remove timber for processing and sale. 2) Allow timber to remain on the ground.
RESOLUTION OF ISSUE	-	Unresolved . . . will depend on which values are chosen and acted on.

Students may suggest other problems and issues which resulted from the eruption of Mt. St. Helens. The instructor should accept as correct those sequences which reflect valid environmental problems and issues which the students can defend.

PHOTO ESSAY (pages 16-23-SM). The photographs used in this section not only represent actual environmental problems but can serve as an additional activity or activities for classroom use. In almost every situation, questions are asked in the captions. The answers to many of these questions will necessitate further student research in order to obtain answers. Almost all captions supply excellent discussion topics. Do not feel limited to using only the questions presented. Students will probably generate others as the essay items are discussed. A beneficial extension of the photo essay would be to supply (or have students supply) other visuals collected from magazines, newspapers, etc. for further discussion. Perhaps a photo file and bulletin board could be established in the classroom as an ongoing reservoir of reference materials.

The section entitled "BELIEFS AND VALUES", which follows the photo essay, presents the students with the roles that beliefs and values play in environmental issues. The instructor is urged to reread certain materials in the teachers edition so that he/she has a mental framework from which to operate when interacting with the students. Pages 4-8 in the "Environmental Literacy" section present an overview of what is known about beliefs, attitudes and values (as well as other variables) and their relationship to environmental issues and their resolution. The section also deals with teaching about beliefs and values. A second section located on pages 13-14 of the "General Comments" portion of the teacher's edition discusses recommended teaching strategies for examining and clarifying values. It cannot be stressed too strongly that regardless of what value clarification strategies the instructor chooses to use, a value fair environment must be established by the instructor so that students feel comfortable expressing their beliefs and values and respect the rights of others to do the same.

EXERCISE I-7 (pages 25-27-SM) is designed to allow students to compare their environmental beliefs and values with those of their classmates. The activity should enable the students to conceptualize the idea that there is no consensus regarding beliefs and values. This may well be one of the more crucial tasks in Module I. It is crucial because it is very necessary for students to begin perceiving what a human value is, and that human values regarding a specific topic differ. It is also important that students do not end this exercise with the opinion that value positions are either right or wrong. The correct concept for students to have is that differing values may exist concerning an issue and that because of this environmental problems exist. Further, it is important to help students conceptualize that values can often be expressed along a continuum from one extreme position to another extreme position. They should also realize that the "neutral" position is often taken because of a lack of information regarding the issue rather than as a lack of commitment to a particular stance.

EXCERCISES I-8 and I-9 (pages 29 and 31-SM) engage the students in analyzing environmental issues in terms of differing values and beliefs which exist regarding that issue. Students may experience some difficulty in labelling particular values which are reflected in the issues. The instructor may wish to discuss the different types of values with the students. Descriptors for some of the values which often play a part in environmental issues are provided below:

Value Descriptors

ETHICAL: present and future responsibilities toward the environment and things in the environment.

MORAL: "should" and "should nots" regarding how humans treat fellow humans.

POLITICAL: the activities, functions, and policies of governments and their agents.

ECONOMIC: the use and exchange of money and materials.

RELIGIOUS: belief systems which are based on faith.

EDUCATIONAL: learning about and understanding how natural systems operate.

AESTHETIC: appreciation of the environment through the senses.

RECREATIONAL: use of the environment for leisure activity.

ECOLOGICAL: maintenance of the health of natural systems (includes ideas of balance, stability, integrity and diversity).

HEALTH: maintenance of positive human physiological conditions in relation to the environment.

In EXERCISE I-8 (page 29-SM) the student identifies the beliefs and values inherent in two different positions taken regarding the issue of the fallen timber on Mt. St. Helens. Although students may have difficulty accomplishing this, every effort should be made to bring them to criterion on this activity. It is important for the students to conceptualize that differing beliefs and values are the basis of every environmental issue and often complicate the resolution of issues. Also, students should realize that unless one becomes aware of the different beliefs and values inherent in a particular issue, one will not be able to understand the issue completely.

Appropriate responses for the Mt. St. Helens' issue analysis are:

The Players: Their Positions	Beliefs:	Values:
Lumber Industry: We should be allowed to enter the area and salvage the downed timber.	1. The lumber is an available and profitable resource.	Economic
Mount St. Helens Protective Association: We should set aside the area as a national monument. Allow no lumbering activity.	1. The area has great potential for wilderness recreation.	Recreation
	2. The beauty of the wild area with its virgin forest is awe-inspiring. Such wilderness beauty is an important resource for all citizens.	Aesthetic
	3. Preservation of this area would provide an opportunity for public observation of natural processes.	Education

In EXERCISE I-9 (page 31-SM) the student must analyze the issue of burning high-sulfur coal. In this activity, the student must identify the different positions taken by three players in the issue, i.e., residents of northeastern U.S. and Canada, power company officials, and coal miners. Students must then identify the beliefs and values underlying each of these positions. The prose on pages 30 and 31 presents a brief summary of the high-sulfur coal issue. The issue is really much more complex than the information presented in the modules denotes and there are more than three players and positions involved. There is a great deal of information on the acid rain issue and the instructor should feel free to supplement the module data. An excellent visual resource is the NOVA telecast entitled "Acid Rain". A transcript of this program is available for $4.00

and can be obtained from:

NOVA
Box 322
Boston, MA 02134

Also, a wealth of printed information is available from:

The Acid Rain Foundation, Inc.
1630 Blackhawk Hills
St. Paul, Minnesota 55122
phone 612/454-2621

The instructor may want to divide the class into small groups and have each group respond to Exercise I-9. An added task might be to identify other players, positions, and concomitant beliefs and values, given that the instructor used supplemental information regarding the acid rain issue. Appropriate responses for Issue Analysis: Burning High-Sulfur Coal are on the next page.

In EXERCISE I-10 (page 32-SM) students are asked to reexamine the four environmental problems they identified on page 11 and decide as to whether they are also environmental issues. The instructor may wish to have the students complete Exercises I-10 and I-11 and then have a discussion on responses to both exercises.

In EXERCISE I-11 (page 32-SM) students are asked to restate two issues of their own choosing and to explain why they are issues. The activity gives them an opportunity to test their abilities to explain the reasons why a certain issue exists. Students usually have little trouble in identifying an issue but many have difficulty explaining why it is an issue. The instructor should patiently guide the students to criterion on this task. The prose on page 33-SM presents the two major criteria which can be used to determine whether the issue rationale is correct. These are:

1. Did it (the rationale) include evidence of man, the environment, and interactions between the two?

2. Were conflicting beliefs and values evident in the students' explanations?

If students are observed to be highly frustrated with this activity it is suggested that the instructor discuss one or two environmental issues with the students, bringing out those factors that do, in fact, make them issues. These can then be put on the chalkboard as models for future reference. Further, the instructor might decide to assign two or three additional issues for the students to do as homework assignments. The student should, of course, identify his/her own environmental issues if this procedure is followed.

Issue Analysis: Burning High-Sulfur Coal

The Players: Their Positions	Beliefs	Values
Residents of northeastern U.S. and Canada: (Their Position) Power plants should not be allowed to burn high sulfur coal, or should be required to install scrubbers.	1. High sulfur coal fumes from Midwestern power plants contribute to acid rain.	Ecological
	2. Acid rain is partially responsible for decline in the environmental quality of the Northeast.	Ecological
	3. Acid rain has caused and will cause economic and recreational losses in the area.	Economic Recreational
Power Company Official: (Their Position) We should be allowed to burn high sulfur coal and should not be required to install scrubbers on existing power plants.	1. Sulfur fumes have not been proven as the cause of acid rain, and no one knows the extent of damage of the acid rain.	Ecological
	2. Scrubbers are too costly. We would have to pass the cost on to our customers and they do not want the added cost.	Economic
Coal Miners: (Their Position) Power companies should be allowed to burn high sulfur coal and should not be required to install scrubbers on existing plants.	1. The sale and consumption of high sulfur coal would put more miners back to work.	Economic

EXERCISE I-12 (page 33-SM) recapitulates the essence of Module I by requiring the students to define "environmental issue". The definition of this term is not an easy task. Still, it seems important to make the student come to grips with a workable and correct definition at this point in time. Since environmental issues are, by their very nature, culturally oriented, man enters the picture. Further, it has already been pointed out that human beliefs and values play a significant role in environmental issue situations. Therefore, the eventual definition produced by the class working cooperatively might be: ENVIRONMENTAL ISSUE: A particular interaction between man and his environment about which there are differing beliefs and values.

COMMENTS ON ENVIRONMENTAL ISSUES (MODULES I AND V)

For many who are inexperienced in perceiving environmental issues, the topics in Module I and V will be most difficult. Students and instructors alike may run out of ideas for issue topics. It is recommended that the instructor thoroughly examine all the modules in a search for issue topics. The authors have used many such topics as exercise material throughout the modules. Many of these topics can be suggested to the student as potential subjects for autonomous research. For example, the photo essay on pages 16-23-SM identifies such subjects as waste disposal, aesthetic pollution, channelization, damming, strip mining, urban sprawl and superhighway construction. Each of these, in more specific form, would serve as a viable topic for autonomous student research or for instructor expansion as ancillary material. The authors listed in the teacher's manual for Module II are an excellent source of further environmental material as are the bibliographic entries on pages 67-68-SM. Students should also be encouraged to search their local community for environmental issue topics.

MODULE II

GETTING STARTED ON ISSUE INVESTIGATION

Introduction

Module I gave you a general overview of environmental problem solving. In the next three modules you will prepare yourself to investigate environmental issues of your choice.

Some of you will want to study an environmental issue which exists in your school, in the community, or in the area where you live. In this case, you can often go right to the problem and observe it with your own eyes. But, some of you will want to investigate issues that cannot be observed first-hand. For example, this would be the case if you were interested in world population issues, conserving the great whales, health hazards produced by African dams, or problems facing endangered species around the world. With these kinds of issues, you would need to go to second hand or secondary sources for information.

This module will help give you the skills you need for collecting information using secondary sources. It will not provide all of the answers though. But, it will help a great deal!

Whenever you do careful research you must be as thorough as you can. Also, you must think critically at each step. Only by being thorough and thinking things through carefully will your conclusions be good ones.

The objectives for Module II will be found on the following pages.

Objectives for Module II

Upon completion of Module II you will be expected to be able to . . .

1. . . . using information concerning the skill of classification, accurately group fifteen environmental issues into each of three assigned categories.

2. . . . logically defend a portion of the classification scheme produced as the result of Objective 1.

3. . . . using information about ways of investigating environmental problems, reclassify the original issues in terms of how they can be attacked for study.

4. . . . after reading a description of an environmental issue, correctly identify problem questions that apply to that situation from a list presented to you.

5. . . . after reading a description of an environmental issue, identify and communicate problem questions that are consistent with that issue.

6. . . . compare two information sources about coal reserves, identify the important data (information, values, value positions) in each source and communicate how these data differ.

7. . . . identify governmental or private agencies to which you can write for specific information about an environmental issue.

8. . . . write a sample letter to an agency asking for information about a particular environmental issue. The letter is to be correct in terms of its general structure, the agency chosen to be contacted, and the kinds of information requested.

9. . . . read two environmental news articles and state at least two differing value positions as expressed in each article.

10. . . . locate and read one environmentally-related article approved by your instructor and write a brief summary which accurately communicates the main point(s) presented.

11. . . . choose an environmental issue, locate three good references concerning this problem, and correctly list these in written form.

12. . . . correctly identify the written information (and symbols) used on a card from the card catalog.

13. . . . correctly identify the written information (and symbols) used in a reference from the Readers' Guide.

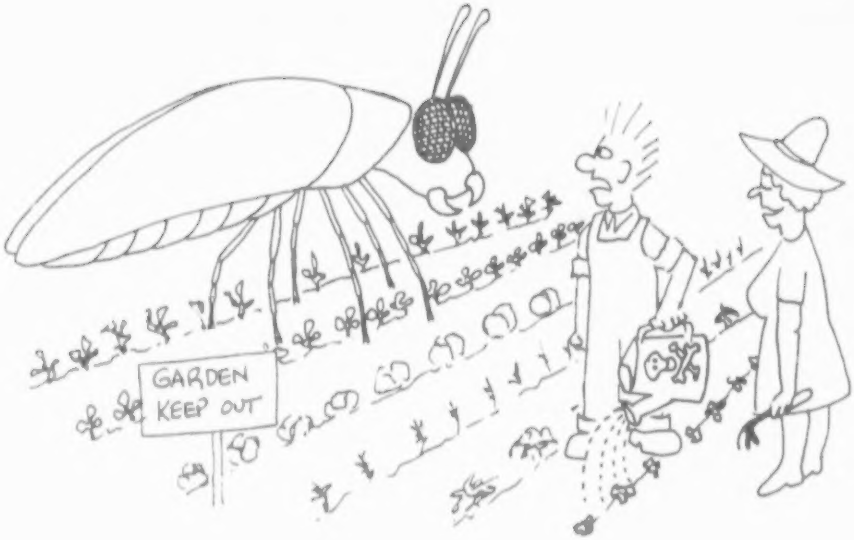
14. . . . analyze a research report dealing with polar bear management and . . .

A. cite one source of information to which the author might have written for more information.

B. explain why the author was unable to answer one of the questions asked in the report.

C. determine if the author's values toward polar bear management are reflected in the report and, if they are stated or inferred, identify where this information is located.

D. state specifically why you consider (or do not consider) the research report to be a good, thorough job of covering the subject.



DARN IT FRED! I WARNED YOU NOT TO USE ALL OF THOSE CHEMICAL PESTICIDES!!!

Another Look at Issues

Whenever a scientist studies objects or events in the environment he or she does so by using one or more of the very important mental skills (or science processes as they are sometimes called). Some of these skills are observation, comparison, measuring, predicting, hypothesizing, and experimentation.

Another skill the scientist uses is classification. When a scientist CLASSIFIES, he or she usually does so by grouping objects or events into groups that contain closely related kinds. Scientists classify many things because this organization produces groups of things that makes them easier to study. Scientists have done this with the elements, chemical reactions, rocks, minerals, plants, and animals. Perhaps you can think of other things that have been classified.

One way that we can look more clearly at environmental issues is to classify them. We could classify environmental issues in many different useful ways. We could group them according to whether they were issues connected with air, water, soil, sound, animal life and so on. And, perhaps this would be useful eventually. Also, we could group them according to how important they are to man. Are they critical? Of mcderate importance? Of only limited importance?

We are going to ask you to classify environmental issues in yet another way. We would like you to think of a number of environmental issues. Please identify one environmental issue that could fit EACH of the following headings. (II-1)

An issue within your school or community (a LOCAL issue): ____________________

____.

An issue within the state or region where you live (a REGIONAL issue): ________

____.

An issue of NATIONAL or INTERNATIONAL importance: ____________________________

____.

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TRASH
ON HIGHWAY

Actually, what you have done (if your issues are correctly identified) is to begin a classification scheme. It is based on the geographic scope of the issue. This way of grouping issues looks at how large a geographic area is affected by the issue. Remember that one way of classifying is not necessarily better than another way. Each can give us a useful way to look at environmental issues. We are going to ask you to become a bit more skilled in classification.

Your next task will be to investigate a number of different sources and to identify four issues under each of the three headings. You may use your own knowledge, interview experts, or go to newspapers, science journals, and reliable magazines. In fact, you can use just about any good source which you can defend to your instructor. Your instructor may also suggest some specific sources to use. And, don't overlook your own powers of observation in the school and community. As you identify these environmental issues, record them on the following page. (II-2)

Local Environmental Issues:

1. ______________________________.

2. ______________________________.

3. ______________________________.

4. ______________________________.

Regional Environmental Issues:

1. ______________________________.

2. ______________________________.

3. ______________________________.

4. ______________________________.

National or International Issues:

1. ______________________________.

2. ______________________________.

3. ______________________________.

4. ______________________________.

Your listing of environmental issues should contain specific issues - ones that you can describe or communicate accurately. Check your lists to make sure you have clearly communicated specific issues.

You may have found, while preparing your lists, that some issues could fit under more than one heading. For example, if your community has a particular problem with illegal garbage dumps you may also find this to be a regional problem. Where do you list this? It seems fair for you to list it under both headings if you can defend doing this.

In science, you must never make a statement that cannot be defended. A scientist simply cannot draw conclusions based on no information. There are some areas of interest to human beings where guesswork is all right but this is not one of them!

With this thought in mind, we are going to ask you to choose ONE issue from each of the three lists you made and DEFEND it. You are to defend it in terms of its being a specific environmental issue within that heading, i.e., local, regional, national, or international. If you have trouble getting started on this activity, you may want to confer with your instructor. (II-3)

Local Environmental Issue: ______________________________

____

Your Defense: ______________________________________

____

____

Regional Environmental Issue: ___________________________

____

Your Defense: ______________________________________

____

____

National or International Environmental Issue: ______________

____

Your Defense: ______________________________________

____

____

Congratulations! You can now identify and defend a selection of environmental issues classified under these three headings. If this is the case, you have come a long way toward being an expert in the identification and classification of environmental issues.

At this time, we are going to ask you to do one more task in connection with the fifteen issues you classified. Let us assume that your instructor was going to ask you to become an expert on each of these issues. This would mean a tremendous amount of research and study for you. You will probably want to look into some of these in detail but you don't have to worry about becoming a real expert with all of them. If you DID have to become an expert on each, how would you go about it?

There are two or three ways of becoming an expert. You can go out and get information (data) on a FIRST-HAND BASIS. This means that if you want to become an expert on the rat population in Chicago, Illinois you will have to go to Chicago and collect your information. This could involve figuring out a way to estimate the number of rats, trapping and checking rats for fleas and other parasites, going through medical records for cases of rat-transmitted diseases or rat bite, as well as many, many other things.

Another way to get information about an environmental issue is to use what are called SECONDARY SOURCES. Here you read research reports, books, newspapers, magazine articles, inspect maps, look at documentary photographs and bring all the information together in a final report of your own. Let's pretend you wanted to investigate the killing and conservation of the great whales throughout the world. It would be pretty hard for you to visit the South Pole as a part of your regular classroom activity. But, the information you want on the great whales is available. All you have to do is to dig it out and put all the facts together.

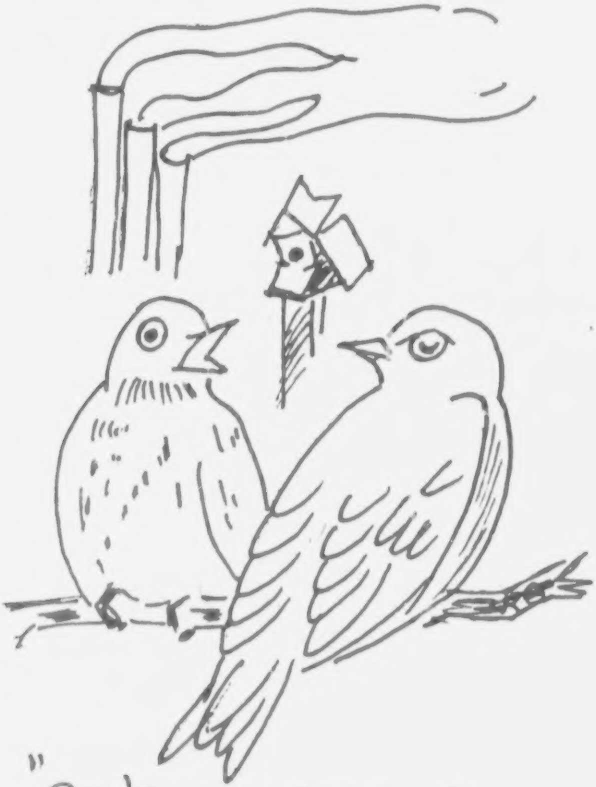
The third way to become an expert is to use a COMBINATION of the two techniques discussed above. With some issues this is entirely possible. For example, if you want to investigate the land reclamation practices of strip mine operators (and you live in a region where there is strip mining) You would want to check the laws and regulations, write and interview experts, as well as investigate practices first-hand in your own region.

Your task now is to go back through your classified issues and CODE each issue. You will need to determine whether the issue can be investigated using first-hand sources, secondary sources, or a combination of sources. Use the code below and write your answer in the margin to the left of each issue. Do this with a colored pencil if one is handy. (II-4)

F = First-hand Investigation
S = Secondary Sources Information
C = Combination of F and S

When you are finished, your instructor may wish to check your coding. Perhaps he/she will want the class to discuss the logic used in the particular codes on this assignment. In any event, check your work to make sure you have thought through this task carefully.

Actually, what you have done here is to CLASSIFY your issues in still another way. Can you explain why this is a different but still a logical classification?



"DON'T YOU THINK ITS TIME WE FOUND A BETTER NEIGHBORHOOD!"

What Are the Problem Questions?

The writer of this module is a good example of a person with mixed feelings about deer. He really doesn't want to go out in the woods and kill a deer. The reasons really don't matter - this is just one point of view or a VALUE DECISION. The value, however, probably deals with how he would prefer to spend his time. The writer might prefer to write, or fish, or take pictures of deer. However, the writer has another set of values concerning deer. These tell him that, in many cases, it is important for other hunters to shoot deer - sometimes thousands of them - even some does (female deer).

These values concerning deer seem to be contrary to logic but they are not. There is great value in killing deer in certain geographic areas. It's just that this writer doesn't like to spend his time that way.

Now, lots of people don't have this writer's values. Many people don't like the idea of killing deer and they don't want anyone else shooting them either. Even more people don't like the idea of killing does. These people number in the tens of thousands - maybe even the millions - and this can cause problems. Let's see if we can analyze a part of this situation.

First of all, let us list a few scientific data for you to consider before you read further. These data concerning deer are:

1. Deer, when uncrowded in a region, can often grow large and strong.
2. Deer, when crowded, can overgraze the land available to them and starve in the process.
3. Where conditions (food, space, etc.) are good, does will breed in large numbers in the fall.
4. Where conditions are poor, does will breed in smaller numbers.
5. Where natural predators (mountain lions, etc.) do not exist, deer populations can grow to enormous numbers in only a few years.
6. About 25% of a deer herd can be killed each fall without decreasing the next year's population. In other words, if we have 4,000 deer available and kill 1,000 in the fall there will be 4,000 available next year in the herd due to reproduction.
7. Many deer killed by hunters in the fall would normally die that same winter from natural causes.

8. Killing one in four deer in the fall will often result in a healthier deer herd in the spring.
9. Overgrazing by deer destroys the habitat for other species, for example, rabbits, grouse, wild turkeys.
10. Huge populations of starving deer can do tremendous damage to agricultural crops in some areas.

Wildlife biologists have the data. They know that there is only so much range available for deer. They know how many deer can be harvested - better, how many deer SHOULD be harvested in order to keep the herds healthy. But, many people don't have these facts or refuse to listen to the facts. There are dozens of reports on long-term fights between wildlife biologists and people who don't want deer killed. Even so, we will look at only one of these fights. The one we will look at is not as famous as some others but it is true.

We must turn back the years and return to Pennsylvania around 1910. At this time, Pennsylvania was introducing deer into regions from which they had almost been exterminated. We won't go into the reasons why the deer had become extinct here but forest fires plus the development of the state by man had a great deal to do with it.

In any event, after 1910, forest fire control was established. Because of this, the food supply for the deer in the state was excellent. Deer feed on what wildlife experts call "browse". Browse largely consists of the tender new growth produced by trees each spring and summer. Young forests produce about 880 pounds of available deer food per acre each year. This amount of food (browse) gets cut back at a fantastic rate as the forest grows. A hardwood forest that is around 35 years old will produce only about 110 pounds of browse per acre. This is much different than the 880 pounds produced by a very young forest.

You might wonder why an older forest produces less available browse than a younger forest. There are several reasons for this. First of all, in a young forest there are many young seedlings producing food. Also, it is close to the ground where the deer can reach it. As the forest grows, many seedlings die due to competition for space. Remaining trees grow tall and the food produced is grown at a height where the deer cannot reach it.

Getting back to the Pennsylvania story . . . around 1930 it is estimated that the state's forests could have a HEALTHY deer herd of about 250,000 animals. Instead, a rich food supply had allowed the animals to reproduce to over 750,000 individuals. You must also remember that deer had few natural enemies in Pennsylvania forests at this time. Even a ten year old who knows something about ecology could tell you that trouble was just around the corner.

The wildlife people of Pennsylvania knew that the situation was serious. Winter food supplies for the deer were just not extensive enough to support this many animals. As deer became hungry they began invading agricultural

A Hardwood Forest With Good Deer Browse. (Photo by H. R. Hungerford)

The mixed hardwood forest seen here contains good deer browse. A variety of trees and shrubs at different sizes provides leaves and tender young twig buds for deer. This forest has a thick growth of smaller plants partly because of the death of some of the larger trees (note the remains of a large tree on the forest floor). This provides space, moisture, and sunlight for many shrubs and tree seedlings to grow. Eventually, much of this forest would grow so high that the deer could not reach the leaves and buds.

land. Thousands of deer were shot by farmers trying to protect their crops. The Pennsylvania Game Commission spent nearly $100,000 to build over 200 miles of deer-proof fence over a 14 year period. This didn't do much to solve the problem. Further, the deer were overgrazing their natural woodland area which also seriously hurt other wildlife species such as rabbits and wild turkey. Many deer died of malnutrition. Poachers took a few illegal deer but this didn't make much of a dent in the population either. Other weak and hungry deer were being run down and killed by wild dogs.

During all this time there was a law on the books that allowed the legal hunting of ONLY male deer (bucks) with antlers. Also, there was tremendous pressure to keep it this way. Even so, over a 25 year period, the law was modified 14 times to permit the taking of antlerless deer. Many people turned out to legally shoot deer for meat and, over the 25 year period, nearly 1,000,000 animals were killed.

At the end of this heavy kill period, Pennsylvania had a formula for hunting which worked out like this: For two years, hunting would be permitted only for mature bucks. During the third year, antlerless deer could be killed. During these third years upwards of 100,000 deer were often taken legally. But, the public screamed about the killing of so many deer. There was widespread bad publicity about the killing of antlerless deer. A buck-only law was put back into law due to public sentiment.

In an effort to increase food production for the deer, the Pennsylvania Game Commission permitted the heavy timbering of some forested areas. This could help promote the growth of young trees. In some areas they even took bulldozers and leveled large areas to promote the growth of seedlings. But, all of this did little good because the deer population was so huge that the animals cleaned out the new growth before it could even get started well.

The Game Commission had the facts and tried to present them to the people. They knew that a HEALTHY deer herd depended on keeping the numbers of deer under control. The best way to control the population was to allow licensed hunters to remove excess animals of BOTH SEXES.

This was the way things stood at the middle of the century. The Game Commission knew what had to be done. The public fought it every step of the way.

This is the end of our story. Just what were the environmental problems connected with this page from history? Do you think YOU could identify the

Deer in Poor Condition. (Photo by Linda Hungerford) What is the eventual fate of these deer if a food shortage continues?

issues connected with this situation? What follows is a list of questions. These questions might or might not be logical environmental problem questions concerning the Pennsylvania deer history. Consider each question carefully in terms of the history presented to you. You will find a blank in front of each question. If the question is a logical one for this historical environmental situation, place an "X" in front of the question. If it is not a logical question do nothing! (II-5)

____ 1. How can public opinion about deer hunting be changed so that opinion is consistent with the facts?

____ 2. Should an animal be reintroduced into its former, natural range when its natural enemies no longer live there?

____ 3. Should both male and female deer be harvested in an area where there are no natural predators and a limited food supply?

____ 4. How can the amount of available deer browse be increased in a limited area?

____ 5. Should big game poachers be arrested and fined even when they might be doing a game population a favor?

____ 6. Should public sentiment be allowed to overrule ecologically sound game management principles?

Still another environmental issue revolves around whooping cranes. The following information is presented to you so that you can analyze it for an important assignment. While studying this information dealing with the whooping crane, you are asked to determine - for yourself - the important problem questions connected with it. You will be asked to state - and possibly defend - your problem questions at the end of this module.

> A young whooping crane recently died from lead poisoning. Only two wild flocks of these birds are still in existence. This young crane was one of the twenty-nine whoopers which winter at the Bosque del Apache National Wildlife Refuge in New Mexico.
>
> Snow geese also winter on the Bosque refuge, and hunting the geese is permitted. Hunters are trained to avoid shooting the cranes, but the goose hunt still drives the whoopers from the refuge. To avoid the hunters, the cranes often feed in the surrounding countryside. This is where the problem occurs. Waterfowl hunting is widespread in the countryside. So is the accumulated lead shot from the guns of hunters. As the whooping cranes forage on the ground for food, they take in the lead shot, just as they would swallow fine pieces of gravel to serve as food grinders in their digestive systems.
>
> An autopsy revealed that the gizzard of the young crane was full of lead. Three lead pellets were also found in the whooper's flesh, indicating that it had been shot as well as poisoned. Even more troubling is evidence that the refuge hunt may be interfering with the reproduction of the cranes. Usually, a male and female whooper will form a pair bond and mate for life. This pair bonding occurs on the wintering ground. It appears that the goose hunt may be interrupting the pair bonding. If so, then the hunt could be an indirect cause for the problems that this flock of cranes are having in reproducing.
>
> The National Audubon Society has demanded an end to the hunting in the Bosque refuge. Since snow geese can be hunted elsewhere in the region, there seems to be little reason to continue hunting in the refuge. This organization has also called for the use of non-toxic steel shot in the nearby areas. (Adapted from "Unhealthy Refuge," Audubon. (March 1984) 4.)

Your job, at this point, is to determine the environmental problem questions that are important for the information presented above. You may already know a great deal about whooping cranes. So you must be extremely careful to ask only those questions which are logical and pertinent for the information given above. Let's see how well you can do. One example is given for you to refer to. (II-6)

Example Problem Question: How widespread are wildlife losses due to poisoning from lead shot?

1. ____

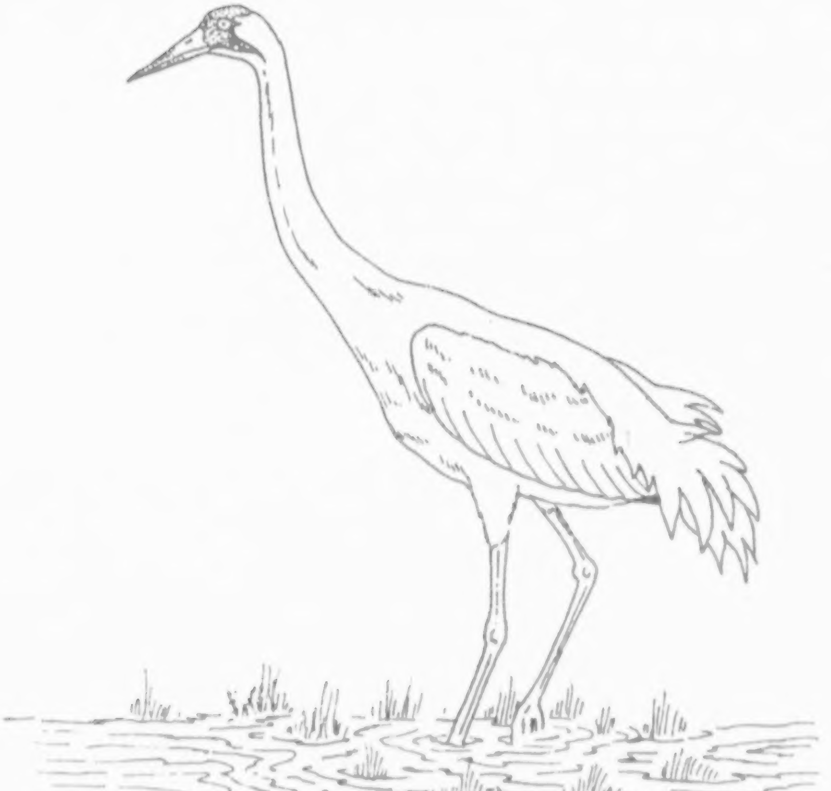
____?

2. ____

____?

3. ____

____?



The Whooping Crane

Where Do I Look?

Once you have decided on your problem question, your real search begins. Finding good information is the key to good research. Where do you get this information? You will probably have to do a great deal of library research. Also, you may find a need for writing for information or for interviewing an expert (or several experts).

What follows are lists of secondary sources of information. In no way are they complete listings. Your chances of finding good, sound information using other sources are excellent. Most libraries, for example, will have a card catalog. Use it! Large libraries also have a publication called The Readers' Guide. Here you can find listed all major articles written on just about any topic on which you want to do research. The lists that follow are only intended to help you get started. Use them in that manner.

Examples of Periodicals and Newsletters Having Research Value:

Title	Publishing Organization
Audubon	National Audubon Society
C. F. Newsletter	Conservation Foundation
Environmental Action	Environmental Action, Inc.
International Wildlife	National Wildlife Federation
National Parks	National Parks Association
National Wildlife	National Wildlife Federation
National Geographic	National Geographic Society
Natural History	American Museum of Natural History
Nature Conservancy News	The Nature Conservancy
Population Bulletin	Population Reference Bureau
Wilderness Report	The Wilderness Society

Examples of Organizations Involved in Aspects of the Environment:

American Forestry Association
919 17th Street, N.W.
Washington, DC 20006

American Petroleum Institute
1271 Avenue of the Americas
New York, NY 10020

American Museum of Natural History
Central Park West at 79th Street
New York, NY 10024

Animal Welfare Institute
P.O. Box 3650
Washington, DC 20007

Bureau of Land Management
U.S. Dept. of the Interior
Washington, DC 20240

Center for Environmental
Education, Inc.
Suite 307
2100 N Street, N.W.
Washington, DC 20037

Center for the Study of
Responsive Law
1908 Q Street, N.W.
Washington, DC 20009

Chemical Manufacturers Assn.
1825 Connecticut Ave., N.W.
Washington, DC 20009

Common Cause
2100 M Street, N.W.
Washington, DC 20037

Conservation Foundation
1717 Massachusetts Ave., N.W.
Washington, DC 20036

Consumer Alliance, Inc.
P.O. Box 1242
Los Altos, CA 94022

Council on Environmental Quality
722 Jackson Place, N.W.
Washington, DC 20006

The Cousteau Society
930 West 21st Street
Norfolk, VA 23517

Division of Air Pollution
Public Health Service
U.S. Dept. of Health,
Education & Welfare
Washington, DC 20201

Energy Research and Development
Administration
12th Street & Penn. Ave., N.W.
Washington, DC 20545

Environmental Action, Inc.
Room 731
1346 Connecticut Avenue, N.W.
Washington, DC 20036

Environmental Defense Fund
1525 18th Street, N.W.
Washington, DC 20036

Environmental Science Information
Center
NOAA
Department of Commerce
Washington, DC 20235

Federal Water Pollution Control
Administration
Office of Public Information
Washington, DC 20242

Forest Service
U.S. Dept. of Agriculture
Washington, DC 20242

Friends of the Earth
529 Commercial Street
San Francisco, CA 94111

Garden Clubs of America
Conservation Committee
598 Madison Avenue
New York, NY 10022

Institute of Scrap Iron
& Steel, Inc.
1729 H Street, N.W.
Washington, DC 20006

Izaak Walton League of America
1800 North Kent Street
Suite 806
Arlington, VA 22209

League of Conservation Voters
324 C Street, S.E.
Washington, DC 20005

League of Women Voters
1730 M Street, N.W.
Washington, DC 20036

National Association of
Recycling Industries
330 Madison Avenue
New York, NY 10017

National Audubon Society
950 Third Avenue
New York, NY 10022

National Commission on Water Quality
1111 18th Street, N.W.
Washington, DC 20036

National Geographic Society
17th and M Streets, N.W.
Washington, DC 20036

National Parks and Conservation Association
1701 18th Street, N.W.
Washington, DC 20009

National Wildlife Federation
1412 16th Street, N.W.
Washington, DC 20036

Natural Resources Defense Council, Inc.
917 15th Street, N.W.
Washington, DC 20005

The Nature Conservancy
Suite 800 1800 North Kent St.
Arlington, VA 22209

Nuclear Regulatory Commission
Office of Inspection & Enforcement
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Planned Parenthood - World Population
801 Seventh Avenue
New York, NY 10019

Population Reference Bureau
1337 Connecticut Ave., N.W.
Washington, DC 20036

Resources for the Future, Inc.
1755 Massachusetts Ave., N.W.
Washington, DC 20036

Scientist's Institute for Public Information
49 East 53rd Street
New York, NY 10022

Sierra Club
220 Bush Street
San Francisco, CA 94104

Soil Conservation Service
U.S. Dept. of Agriculture
Washington, DC 20401

Soil Conservation Society of America
7515 N.W. Ankeny Road
Ankeny, Iowa 50021

Tuberculosis & Respiratory Disease Association
National Headquarters
1740 Broadway
New York, NY 10019

Water Pollution Control Federation
2626 Pennsylvania Ave., N.W.
Washington, DC 20037

The Wilderness Society
1901 Pennsylvania Ave., N.W.
Washington, DC 20006

Zero Population Growth
1346 Connecticut Ave., N.W.
Washington, DC 20036

Regional Offices of the U.S. Environmental Protection Agency

Region I
Environmental Protection Agency
Room 2303
John F. Kennedy Federal Building
Boston, MA 02214

Region II
Environmental Protection Agency
Room 1009
26 Federal Plaza
New York, NY 10007

Region III
Environmental Protection Agency
6th & Walnut Street
Curtis Building
Philadelphia, PA 19106

Region IV
Environmental Protection Agency
1421 Peachtree Street, N.E.
Atlanta. GA 30309

Region V
Environmental Protection Agency
230 South Dearborn
Chicago, IL 60604

Region VI
Environmental Protection Agency
First International Building
1201 Elm Street
Dallas, TX 75270

Region VII
Environmental Protection Agency
1735 Baltimore Avenue
Kansas City, MO 64108

Region VIII
Environmental Protection Agency
Suite 900
1860 Lincoln Street
Denver, CO 80203

Region IX
Environmental Protection Agency
100 California Street
San Francisco, CA 94111

Region X
Environmental Protection Agency
1200 6th Avenue
Seattle, WA 98101

Examples of Local Resource People:

U.S. Senator or Representative
State Legislators
County Board of Supervisors
County Clerk
County Superintendent of Highways
County Conservation Officer
City Mayor and City Council
City Zoning Commission
City Planning Commisioner
Code Enforcement Officer
School Principal
School Nurse
Biology Teacher
Chemistry Teacher
Earth Science Teacher
Social Studies Teacher
Officials from Local Environmental
    Organizations (Sierra Club,
        (Audubon, Izaak Walton League, Ducks Unlimited, etc.)

Insect & Rodent Control Specialist
Animal Control Specialist
Museum Curator
Water Plant Superintendent
Waste Water Engineer
Alcohol and Drug Abuse Center
Mortician
Real Estate Developer
The Utility Companies
Corporate or Industrial Personnel
Newspaper Editor or Reporters
Wildlife Biologist
Ecologist
Agronomist
Petroleum Geologist
Landscape Architect
Family Planning Consultant

Watch Out!!!

Yes, watch out! You can get into lots of trouble when using secondary sources. Why? Because, if you are not careful and thorough, you'll wind up with only one side of the story. This is very dangerous when it comes to making decisions.

You will recall learning that environmental issues reflect differing human values. In fact, if there weren't different sets of values, there would not be any issues. If some people did not value quiet, there wouldn't be anyone yelling about noise pollution around our major airports. If certain people didn't throw gum wrappers, match covers, and beer cans along the roads and in the streets (or parks), we would have little concern for littering. If all utility companies used effective emission control devices on their smoke stacks, few people would yell about air pollution caused by electric utilities. If all towns and cities had good sewage treatment plants, there would be little need for ecologists (and others) to be concerned about pollution of the streams and rivers.

All of the issues above have two sides - sometimes several sides - to them. These "sides" are different groups of human beings operating on different values. You might find it interesting to try and identify the different values operating in each of the above issues.

Let's take a look at a couple of secondary sources and see why it's possible to come up with information that just might not be totally accurate - or, at least show only one side of the story.

(II-7)[1] Several years ago, General Electric published an advertisement dealing with man's limited coal supply and the need for developing nuclear generators for supplying electricity. The main text of that advertisement can be found on the following page.

---

[1] All of the information for Exercise II-7 taken from the May 27, 1972 issue of Environmental Action.

> Experts say that all the economically recoverable coal in the U.S. may disappear in 80 to 150 years - the world's supply in 300 years. And gas and oil before then.
>
> The world must find other fuels. Especially new fuels to generate electricity.
>
> One answer is nuclear power. General Electric has 68 nuclear plants in the works to help meet electric needs for years to come.
>
> For beyond that, GE is working with the government and utilities on a new nuclear power plant - a fast-breeder reactor.
>
> The fast-breeder has already been tested. Not only will it make electricity. It will make fuel . . . more than it uses. So it will postpone the fuel shortage . . . perhaps for thousands of years.
>
> GE is also working on ways to transmit more electricity over present wire - and new underground distribution systems.
>
> There's no easy way to meet future energy needs. But GE is working to make it easier.

It is clear that General Electric is attempting to convince the public of something. What is it? Please write your answer below:

____

____

____

____

____

Yes, it would appear that GE is trying to convince the public that nuclear power plants are urgently needed. Now, what is the argument that General Electric is using? Please write this below:

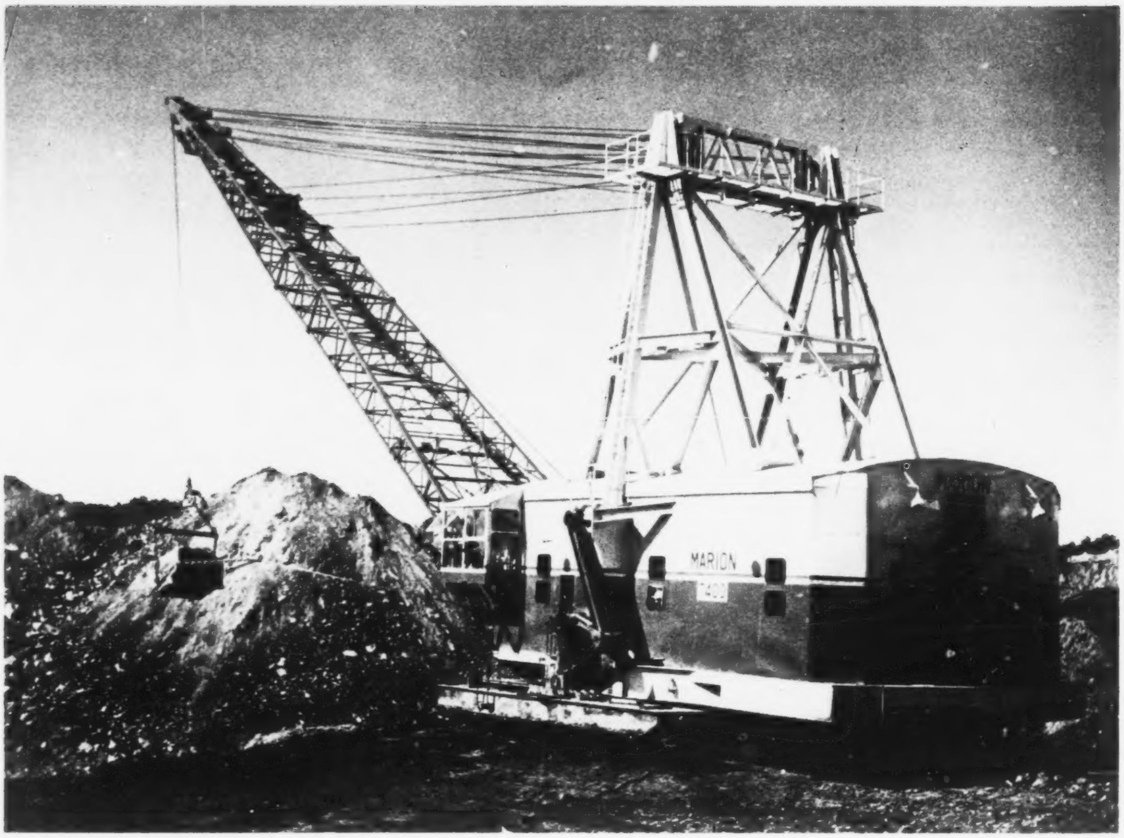
____

____

____

____

____



GE's basic argument lies in the limited amount of recoverable coal available for the production of electrical energy. According to GE, the recoverable coal supply will be gone in 150 years or less.

Now, let's turn to another secondary source on the topic of coal. The following data were prepared from Bureau of Mines statistics of the same year in which GE's advertisement appeared.

Life Expectancy of Coal Reserves

The following is the estimated time table for depletion of presently recoverable bituminous coal and lignite reserves, assuming annual production figures of 1970.

	Quantity (billions of short tons)	Life Expectancy
Total deep mine reserves	356	590 years
Deep mine (low-sulphur) reserves	221*	367 years
Total strippable reserves	43	71 years
Strippable (low-sulphur) reserves	31	51 years

*This figure is about 1118 times the total amount of surface-mined coal burned by electric utilities in 1970.

In what ways do the figures from the Bureau of Mines differ from those presented by General Electric? Please write your answer below:

It would appear that it might be dangerous to rely on only one source of data (information) regarding a specifc issue. Note that we are not attempting to tell you which set of figures is right. Certainly, one is wrong. Could they both be wrong? How might you go about an investigation to produce the answer to this question? This is a fairly tough task, but it is absolutely essential if you are to come up with reliable information concerning an issue.

Letters for More Information

There are times when it is necessary to sit down and write a letter for information. Although letter-writing is basically something you learn in your English class, there are a couple of points that we want you always to keep in mind when writing an information-seeking letter.

First, go to the source that seems to be the best for your particular purpose. Some students make poor choices as to where to write for information. However, at this time we would guess that you could make good choices. Let's see how well you can do.

Earlier in this module you found a list of agencies that could provide information on various aspects of the environment. Following this paragraph you will find two specific problem questions. Just where would you go for the answers to these questions? Please indicate the agencies you would write to for information relating to each question. (II-8)

Problem Question 1: How many acres of timber are harvested each year in the national forests? (To which agencies would you write?)

Choice 1: ______________________________.

Choice 2: ______________________________.

Problem Question 2: What human values are at work which keep the world's population growth from reaching zero? (To which agencies would you write?)

Choice 1: ______________________________.

Choice 2: ______________________________.

There is a second point you need to keep in mind when writing for information. It is simply this: BE VERY SPECIFIC IN YOUR REQUEST! People who work in the agencies to which you will be writing have one major complaint. They get letters from students requesting all the information they have - on everything. Such requests make their jobs impossible. Some agencies have stopped answering such letters. Requests like this show only that the student has not thought much about what he or she is doing. Can you blame officials for not answering these kinds of letters?

Earlier in this module, you were presented with two different sources that gave two very different pictures concerning coal reserves. If you were studying the issue concerning the use of fossil fuels you might want more information. At least this is what one of the authors of this module thought. Therefore, more information was sought.

Of course, the first step was to identify an agency from which the necessary information could be obtained. On the following page you will see the letter which was written for more information about coal reserves. Note the specific information requested. After this letter you will find the letter which was received in response to this request. You will observe that the writer of the letter went to a great deal of work to try to provide good information in answer to a very specific request.

The letter requesting information:

Science Education
College of Education
Southern Illinois University
Carbondale, Illinois 62901
18 September 1972

Mr. Lew S. Weber
Midwest Coal Producers Inst.
Wildwood Lane
Springfield, Illinois 62700

Dear Lew:

I am trying to get an expert's opinion on a question that has been raised via conflicting references. You are probably in a position to know something about the topic since it deals with available coal reserves.

Some time ago General Electric sponsored an advertisement which stated that the reserves of economically recoverable coal in the United States would last no longer than 150 years. This statement was used as a defense for producing nuclear power stations.

Now, the Bureau of Mines has reported that, based on electric utility consumption in 1970, we have in excess of 200 billions of short tons of recoverable low-sulphur coal from deep mine reserves. Low-sulphur strippable reserves are put at about thirty short tons. This gives us about 250 years of reserves based on current consumption.

I have heard you say that demand will increase sharply over the years. However, there must be a set of figures that one can turn to with some degree of confidence regarding the recoverable reserves of coal. Do you suppose you could pass some reliable estimates on to me?

You are probably naturally curious as to what I want with these figures. I am currently helping prepare a modular training program in environmental education for middle-school students. I simply need reliable figures to work from.

I sincerely hope that all goes well with you and your work. Please drop by and see me when you are in Carbondale; it would be a pleasure to talk with you.

Respectfully yours,

Harold R. Hungerford, PhD
Science Education

The reply letter from Mr. Weber (addresses not included):

Dear Harold:

. . . usually any estimate is subject to change due to changes in figures and conditions upon which the estimate was made.

I think that we have all in our reading run across various numbers that have been given to our coal reserves, but I believe if I were you I would accept the current figures set forth in the Bureau of Mines' Mineral Yearbook covering coal - bituminous and lignite. This publication provides the most comprehensive breakdown of this estimate that is available. It breaks it down by state and by the various classes of coal, shows depletion and remaining reserves and also a column designated "Recoverable Reserves". One reason for the variation in these figures is that some present estimates on the basis of reserves on which there is some basis for existence and in addition present estimates on belief that additional coal measures exist upon which there is no present evidence.

The September 1972 issue of Coal Age on page 95 lists the estimated reserves for the United States as 3,210 billion tons. The 1970 Minerals Yearbook lists 1,556 billion tons of remaining reserves. In this case, I believe the 3,210 billion tons includes the Bureau of Mines estimate of 1,556 billion tons plus another like amount upon which there is no present evidence (as stated above).

It is also of interest to note that the Bureau of Mines assumes only 50 percent recovery and this reduces the 1,556 billion to 778 billion tons. Often this latter figure is further qualified with the explanation that it would not be possible to recover all of this coal with current mining technology and economic conditions . . . (and therefore some reduce this down to one-quarter which still provides for several hundred years at the current rate of consumption).

Sincerely,

L. S. Weber
Director of Conservation

As you can see, the letter from Mr. Weber was a big help in obtaining additional information about coal reserves. And, he also suggested still another source of information.

How well do you think you could do requesting information from an agency by letter? We are going to give you (and your instructor) a chance to find out.

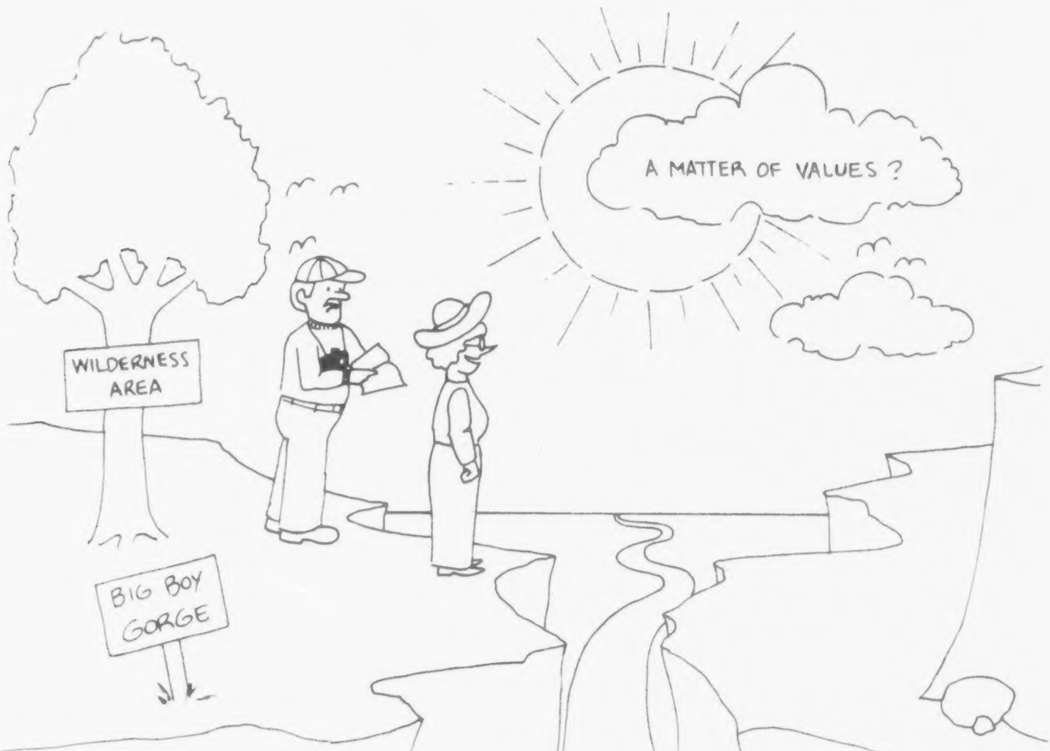
Please think of a specific piece of information that you might obtain from one of the agencies listed on pages 51-54 of this module.

Pretend you need this information. On a separate sheet of paper write that letter. Your letter will be judged in terms of its general structure, whether you have written an appropriate agency, and whether you have been specific in your request.

If you are worried about a proper form to use in writing your letter, why don't you take a look at the two letters you just read in this module as examples (remember that the headings were left off the second letter!)? (II-9)

Seeking Information From Resource People

Often your local community contains individuals who know a great deal about certain environmental issues. These people are usually very willing to share their information. Resource people may also have pamphlets, maps, and other literature on a specific topic. In your search of secondary sources, do not overlook the possibility of contacting such people.



I DUNNO HAROLD, THERE OUGHT TO BE ROOM FOR JUST ONE McDONALD'S!

If you should choose to seek information through a personal contact, remember to apply the same points that were emphasized about writing letters for information. Choose the best resource person for your particular purpose and be specific in your requests to that individual.

When you meet with the resource person, be courteous and polite. These people are often quite busy, so you don't want to take too much time for an interview. Plan your questions carefully beforehand so that you can be efficient during the time you have. A final suggestion is to remember that each person you contact for information has his or her own value position. As you go over the information you have received from a resource person, remember that it may show you only one position on the issue. Evaluate the information carefully!

Checking Those Values

(II-10) Please don't think that you will find only one set of values in each of the secondary sources you read. Many articles, books, and news articles attempt to present differing views even though the author's position might be obvious.

At this point, we are going to have you look at two short news articles. In each of these articles, opposing sets of values are either clearly stated or strongly implied. As you read these, attempt to identify the differing values. You will be asked to state what those differing value positions are.

First Article: Adapted from "'Rescued' Deer Die," Outdoor News Bulletin. (February 11, 1983) 2.

> Animal protectionists have killed another population of deer. These deer were a part of a herd which occupied Angel Island State Park, located in San Francisco Bay. As time went on, the deer herd outgrew its available food resources. Angel Island could no longer support the increased deer population.
>
> Wildlife biologists from the California Department of Fish and Game recommended that the best way to reduce the number of deer was to shoot the excess. They said shooting would be the most humane and economical way to handle the problem. But animal protection groups disagreed. They felt it was cruel to kill the animals. The protectionists sued the state and won. This forced the state to remove the extra animals to an area with less deer.

Biologists captured and moved 203 deer to the Myacamas Mountains, about 100 miles from Angel Island. It cost the state $300 to move each deer. Approximately 85% of the deer died during the first year. Their deaths were blamed on the poor condition of the deer which were already weakened by poor diets and low food supply when they were moved.

Second Article: Adapted from "The Hunt for Illegal Skins and Furs," Business Week. (March 7, 1983) 70-71.

Each year the U.S. imports nearly $500 million worth of goods made from animal parts. In recent years, American consumers have developed a growing appetite for "exotics" - snakeskin boots, alligator handbags, ivory jewelry, and expensive cosmetics made from animal-based oils. Because the exotic species are scarce and bring high prices, illegal importing has increased as well.

Federal agents say as much as 30% of the wildlife imports which enter the U.S. are illegal. Many imports are obtained from endangered species. Others enter the country without proper papers. U.S. retailers claim that the practice of "wildlife laundering" - falsifying documents to disguise their illegal nature - makes it almost impossible for them to determine whether the imports are legal.

Retailers are still buying legal varieties of exotic reptile skins, handbags, shoes, belts, and wallets. Many argue that they have no way of knowing whether an import is legal or illegal. Other people, including Britain's Prince Philip, international president of the World Wildlife Fund, disagreed.

Some U.S. retailers say the exotic goods portion of their business is just not worth the bother. Others have moral reasons for not trading in certain goods. Still others just continue importing those goods and run the risk of being caught and paying the fines.

Just what are the differing value positions in each of these two articles? Remember, if one position is strongly implied and not stated outright, it is perfectly all right to identify it as a value position.

Value positions in "rescued deer" article:

1. ______________________________

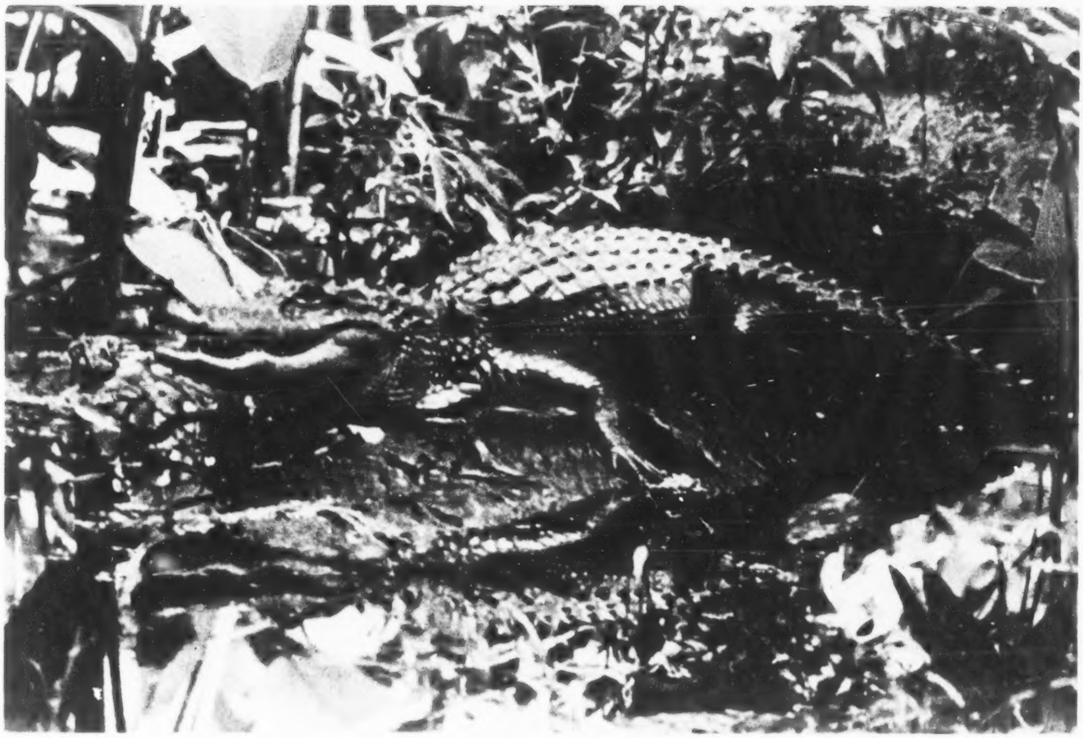
____

____

2. ______________________________

____

____



Value positions in illegal imports article:

1. ______________________________

____

____

2. ______________________________

____

____

Actually, there is a third value position in the illegal imports article. Can you identify it? What is this value position?

Summarizing What You Read

If you study a problem that forces you to go to secondary sources, you are going to have to keep some sort of record to keep the facts straight. And, you are going to have to able to show where you got your information.

One way to keep records is to use note cards or a section of a notebook in which you record summaries of articles you read. Any summarization should hit hard at the main point(s) of the article in a logical and understandable manner. It should be complete enough to be useful when next you need it. However, it should also be to the point, without unnecessary wordage.

It would take too much space to reprint a full-length article here and then summarize it for you. Even so, we are going to cite an article and write a summary of it so you can see a real summarization of an article dealing with an environmental issue.

Let us assume we are investigating air pollution from automobile emissions. What follows is a summary of one of the articles read:

> Lyden, J. "Nobody Wins With Lead," National Wildlife. (December 1984-January 1985) 46-48.
>
> In January 1984, aldermen in the Chicago City Council began a heated debate over whether to ban the sale of leaded gasoline within the city limits. Some felt the ban was needed in order to bring relief to the biggest victims of lead poisoning: underprivileged children.
>
> Lead, found in the exhaust from gasoline engines, displaces other minerals in the human body. It often settles in bone and brain tissue. The result: learning problems, retardation, and a number of health disorders. Because they live closer to heavy concentrations of traffic and its fumes, poor children are seven times as likely to have high blood lead levels as middle-class children.
>
> In Chicago, economics seemed to be at the heart of the debate. The Illinois Gasoline Dealers Association warned the City Council that the ban would cost the city millions of dollars in lost tax revenues and fees. Jobs would also be lost as dealers and buyers moved outside the city limits to avoid the ban. Alderman Joseph

Kotlartz argued back, "The medical testimony shows that leaded gas is depriving our children of full life, and in some instances of life itself." In September 1984, the debate ended. Chicago became the first city in the U.S. to outlaw the sale of leaded gasoline.

At this point in time we are going to ask you to read an article concerning one environmental issue and summarize it. Following this paragraph is a list of suggested articles which could be chosen for such a task. Your instructor can also give you permission to read a different article. There are many available.

Article Reference List:

Canby, T. "Water: Our Most Precious Resource," National Geographic. (December 1980) 144-179.

Clark, T.W. "Last of the Black-Footed Ferrets?" National Geographic. (June 1983) 828-838.

Cole, J.N. "We're Losing Our Precious Farmland!" National Wildlife. (August-September 1982) 12-15.

Daniels, P. "Prowlers on the Mexican Border," National Wildlife. (October-November 1983) 14-17.

Farney, D. "Can the Tallgrass Prairie be Saved?" National Geographic. (January 1980) 36-61

Fisher, A.C. "My Chesapeake - Queen of Bays," National Geographic. (October 1980) 428-467.

Gibbons, B. "Do We Treat Our Soil Like Dirt?" National Geographic. (September 1984) 350-389.

Gould S. & McTigue, B. "Radioactive Wastes: A Barrel of Trouble," National Wildlife. (April-May 1983) 20-23.

Iker, S. "Swamped With Deer," National Wildlife. (October-November 1983) 4-11.

Laycock, G. "Socking It to the Poachers," Outdoor Life. (January 1981) 54-55+

Leydet, F. "Coal Versus Parklands," National Geographic. (December 1980) 776-803.

MacDougall, W. "Crisis Ahead in Our National Parks," U.S. News and World Report. (September 27, 1982) 74-75.

Macy, M. & Steinberg,L. "A Feast of Eagles - Chainsaws Vs the Food Chain," Sierra. (July-August 1980) 26-29.

Madson, J. "American Waterfowl: Troubles and Triumphs," National Geographic. (November 1984) 562-599.

McNamee, T. "Breath-Holding in Grizzly Country," Audubon. (November 1982) 68-83.

McNamee, T. "Trouble in Wolf Heaven," Audubon. (January 1982) 84-95.

Miller, J.N. "The Energy Crisis: There Is An Easy Answer," Reader's Digest. (June 1980) 73-81.

Myers, N. "The Selling of the Zebra," International Wildlife. (January-February 1978) 26-31.

Oakley, G. "Wildlife Makes Cents," National Wildlife. (August-September 1984) 33.

Rearden, J. "The Chilkat Miracle," Audubon. (January 1984) 40-54.

Ruby, D.J. "Energy From L.A.'s Sludge," Popular Science. (September 1983) 28.

Steinhart, P. "The Edge Gets Thinner," Audubon. (November 1983) 94-126.

Toner, M. "The Kite Hangs by a Thread," National Wildlife. (August-September 1984) 38-43.

Whitaker, Z. & Whitaker R. "If They're Killers, What Good Are They?" International Wildlife. (May-June 1977) 12-16.

Zeleny, L. "Song of Hope for the Bluebird," National Geographic. (June 1977) 854-865.

Write Your Article Summary Here: (II-11)

The Article: ______________________________

____

____

The Summary: ______________________________

____

____

Is your article summary brief but complete? Does it get at the main point(s) in the article? Does the summary capture the value position (bias) of the writer (if such exists)? Does the summary contain valuable information that you could use later in a report on the topic?

Share your summary with your class. Can your classmates identify the main idea of the article from your summary? Perhaps two of you have summarized the same article. How do the summaries compare? Do both of the summaries contain the same main points? Of course, your instructor may want to evaluate your summary.

The Search for References

You have just finished summarizing one article. Perhaps you found the subject matter interesting - perhaps not. Of course, you might also have found the article to be of little value in terms of that particular environmental issue. As you already know, not all references are of equal worth. Not all references agree. Some reflect misinformation or only one value position. Once again, we point out how IMPORTANT IT IS TO OBTAIN MORE THAN ONE VIEWPOINT WHEN USING SECONDARY SOURCES.

Can you find more than one reference on a particular topic? How good are your research skills? The next task may prove to be difficult and frustrating for you. We are going to ask you to pick a topic that demands the use of secondary sources. When you have picked your topic, you are to search for three (3) separate articles or similar references on that topic. Unless your instructor tells you otherwise, you are to complete this search in a library.

Once the topic has been chosen, find information from at least two different sources. This simply means that we do not want you to pick a topic and then get all of your information from one source, e.g., National Wildlife.

When you have found all three references please list them in the space provided further on in this module. The listing of articles in the previous section of this module should help you see how these articles should be listed. If you run into a problem writing out your references, check with your instructor.

Following this paragraph is a listing of sample issues from which you might choose. Some topics will be more difficult than others when searching for references. Also, you may have another topic in mind that you would prefer to research. If your instructor gives you an okay to work on another topic, it is perfectly all right.

Possible Topics for Library Research (II-12)

Problems of Garbage Disposal
Protecting the Great Whales
Soil Erosion
Preservation of Salt Water Estuaries
Radiation Hazards - War and Industry
Mercury in the Environment
Hard Pesticides
City Planning
Problems of Urban Population Centers
Littering

Alligator Poaching
Auto Exhaust Emissions
Endangered Plant Species
Water Pollution
Strip Mining
Noise Pollution
Pollution of the Great Lakes
Alternative Energy Sources
Religious Attitudes Toward Birth Control
Destruction of Tropical Rain Forests
Depletion of the Fossil Fuels
Acid Rain
Glass and/or Metal Recycling
Abandoned Cars
Conservation of the Bald Eagle
Oil Spills
Human Population Explosion
Air Pollution
Thermal Pollution
Land Use Management
Wilderness Preservation
Rats in Man's Environment
Predator Control

State the Issue Chosen: ______________________________

____

References:

1. ____

____

2. ____

____

3. ____

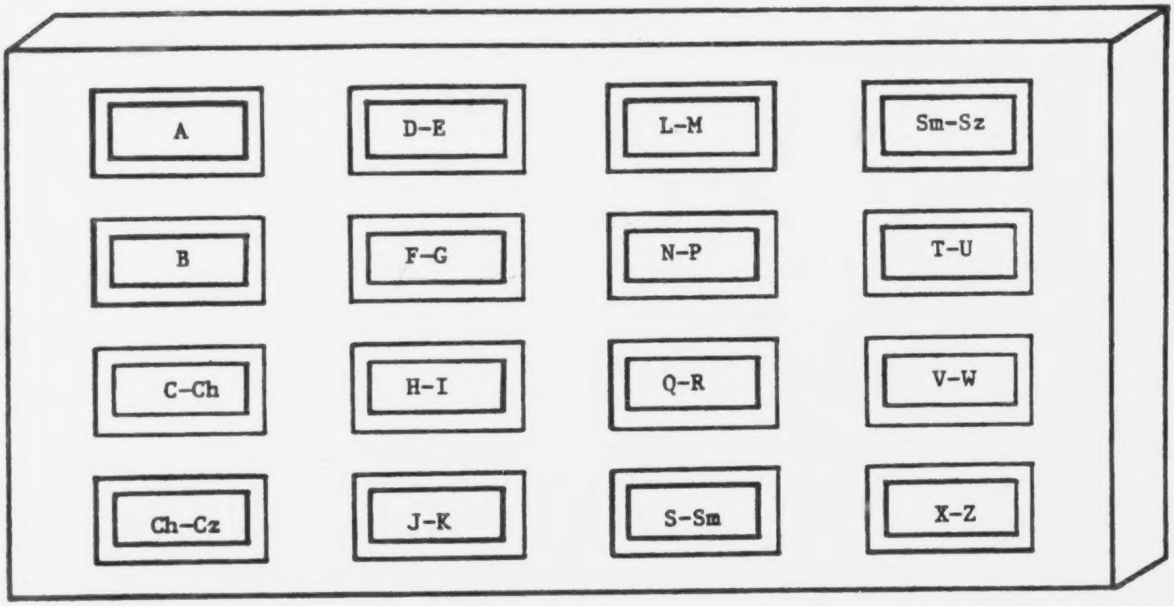
____

____

You may have noticed some frustration in finding good articles from references in the library. This could be due to your inability to successfully carry on such research in an expert manner. The library is an excellent place to gather information from secondary sources, but you MUST know how to use it before it becomes an effective tool. If you are not expert in this area, the next few pages will be of tremendous help. Please take them seriously!!!

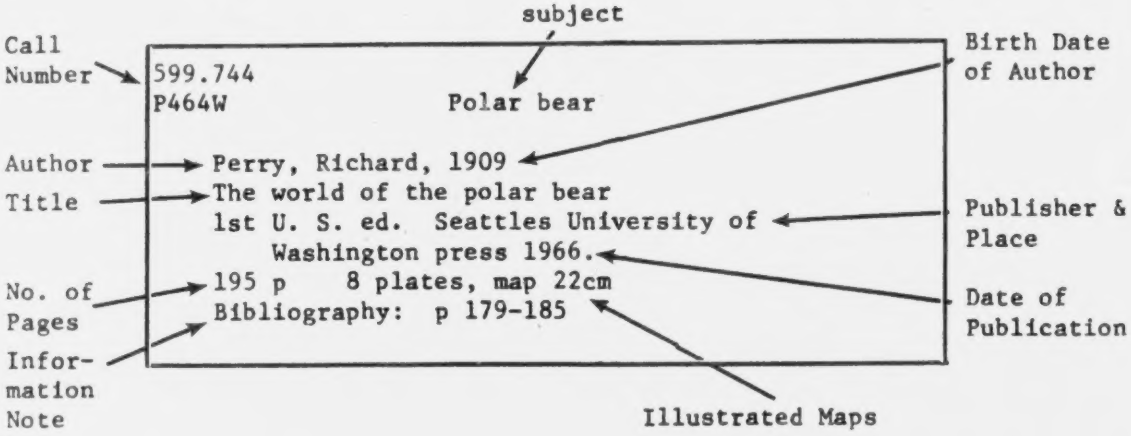
The Card Catalog

Most libraries contain one or more card catalogs. These are usually wooden or metal filing cabinets containing one or more cards on every book found in that library. The drawers, as well as the cards found within them, are arranged in alphabetical order. On each drawer is one or more letters that serve as guide letters. These letters tell you which cards can be found in that particular drawer.



Inside these drawers are catalog cards. There are basically three types of catalog cards. These are called "author cards", "title cards", and "subject cards". On each of these cards is found a considerable amount of information. Below are samples of each of these cards. Please note the information to be found on each.

Sample of Subject Card


599.744
P464W Polar bear

Perry, Richard, 1909
The world of the polar bear
1st U. S. ed. Seattles University of
Washington press 1966.
195 p 8 plates, map 22cm
Bibliography: p 179-185

subject
Call Number
Birth Date of Author
Author
Title
Publisher & Place
No. of Pages
Date of Publication
Infor-mation Note
Illustrated Maps

Sample of Title Card

599.744
P464W The world of the polar bear

Perry, Richard, 1909-

The world of the polar bear by
Richard Perry
1st U. S. ed. Seattles University of Washington
Press 1966.
195 p 8 plates, map 22 cm
Bibliography: p 179-185

Sample of Author Card

599.744
P464W Perry, Richard, 1909-

The world of polar bear by
Richard Perry
1st U. S. ed. Seattles University of Washington
Press 1966.
195 p 8 plates, map 22 cm
Bibliography; p 179-185

As you can see, the three sample catalog cards pertain to the same book. There are, however, three different "headings" a person could have looked under to find this book on polar bears. If a person does not know the title of a book and knows what subject he is interested in or the name of an author noted for work in that area, he has at least two options open to him in terms of searching for an appropriate book. This strategy is known as "cross referencing". Of course, if you know the exact title of the book you are looking for, you are all set. But, how many times will you know exactly *the* book for which you are looking?

Some libraries have separate card catalogs for each type of card. Other libraries, however, often interfile the three cards in one or two catalogs.

Assume that you have found the card that is meaningful in your search for information. How do you find the book? Books are arranged on the library shelves according to the Dewey Decimal System - books are broken down in this arrangement according to ten (10) main classes. These are as follows:

000-099 - General works and reference materials (such as encyclopedias)
100-199 - Philosophy, psychology
200-299 - Religion
300-399 - Social Studies
400-499 - Languages
500-599 - Sciences, mathematics, geology, botany, zoology, etc.
600-699 - Useful (applied) arts and sciences such as medicine and engineering
700-799 - Fine arts such as art, music, recreation, etc.
800-899 - Literature such as novels, poetry, essays, drama, etc.
900-999 - History, geography and travel

The call number on the catalog card will help you locate your book. The first three numbers will tell you to which "class" your book belongs. The book on polar bears was numbered 599.744. This means that it belongs to the "500 class" or that one dealing with the sciences. You would simply locate the area of the library in which the "500" books are shelved and search for 599.744. Books are arranged within each class in numerical order. This means, for example, that a 586 book will be shelved in front of the 599.744 book for which you are looking.

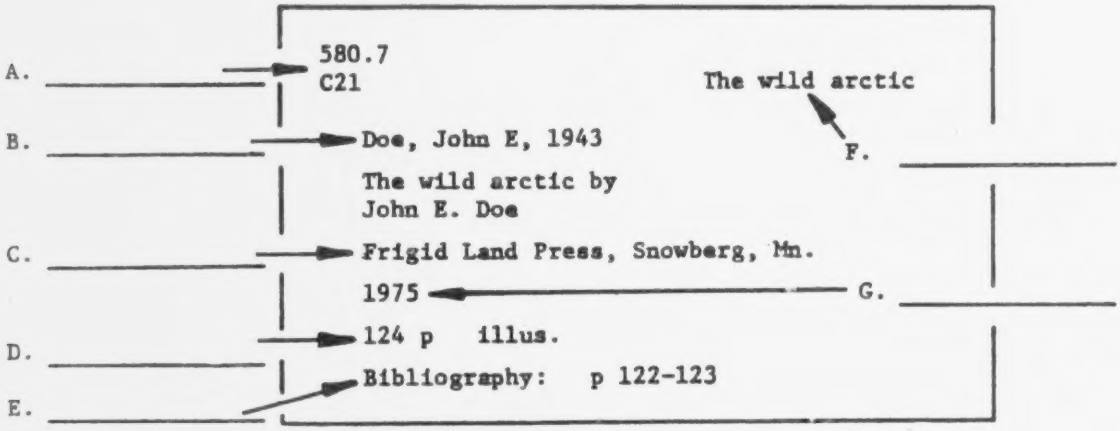
(II-13) Looking Back at Catalog Cards - "Just for fun", let's see how much you can remember about the data found on cards in the card catalog. Respond to the two questions below and then fill in the blanks which surround the model card designed for this purpose:

a. What kind of card is the one seen below? ______________________

____

b. In what area of the library would this card be found? __________

____



580.7
C21
The wild arctic

Doe, John E, 1943

The wild arctic by
John E. Doe

Frigid Land Press, Snowberg, Mn.

1975

124 p illus.

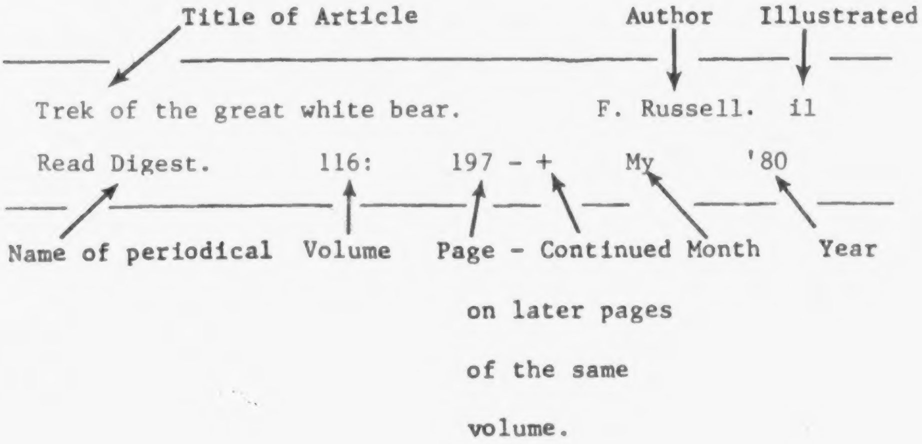
Bibliography: p 122-123

A Good Friend: The Readers' Guide

Many times you may not be able to locate books that pertain to a particular topic - or, you might not be able to locate enough information in books. What do you do then? If this becomes a problem, DO NOT DISCARD the topic for research! Chances are you can find a good deal of information by using another source - The Readers' Guide.

Using The Readers' Guide is not at all difficult once you get the hang of things. This publication is actually a series of books that contain listings of articles published in periodicals (periodicals are magazines published at different intervals - monthly, bi-monthly, quarterly, etc.) The articles found in The Readers' Guide are classified alphabetically according to subjects. The entry following deals with bears. Note the information you can get from this entry.

Subject: BEARS


Title of Article
Author
Illustrated
Trek of the great white bear.
F. Russell.
il
Read Digest.
116:
197 - +
My
'80
Name of periodical
Volume
Page
- Continued on later pages of the same volume.
Month
Year

At the beginning of each volume of The Readers' Guide there are explanations to help you interpret the information you will find in each listing. This explanation consists of the following items:

1. Abbreviations of the periodicals indexed.
2. Key to other abbreviations used.
3. Sample entry with explanation of each part of the listing (see previous page).

Of course, the final step would be to take the articles found listed in The Readers' Guide and go to the periodical section of the library and find the actual articles (assuming that the library in which you are working keeps those particular periodicals.) Periodicals are arranged on the library shelves alphabetically and then in numerical order according to volume number.

Cross Indexing - The Readers' Guide

Occasionally you may have a difficult time locating reference materials if you do not understand cross indexing. Cross indexing is a term that refers to locating reference materials on a particular topic by looking under the "headings" of related topics.

Let us assume that you need to locate information regarding solid waste disposal. You go to The Readers' Guide in the library and find that there is not a single article under the heading, "Solid waste disposal". However, there is a note which suggests that you look under "Refuse and refuse disposal". You then look under this heading and find, just to mention a few:

Food waste is energy waste. A. Borghese. bibl Environment 23:2-4 Jl/Ag '81

No room at the bin (solid waste disposal). J. Marinelli and G. Robinson. il Progressive 45:22-27 D '81

Telltale litter (opinions revealed by littering behavior). C. Rubenstein. Psychol Today 15:19-20 D '81

Waste management: Beyond the throwaway ethic. N. Seldman and J. Huls. bibl il Environment 23:25-36 N '81

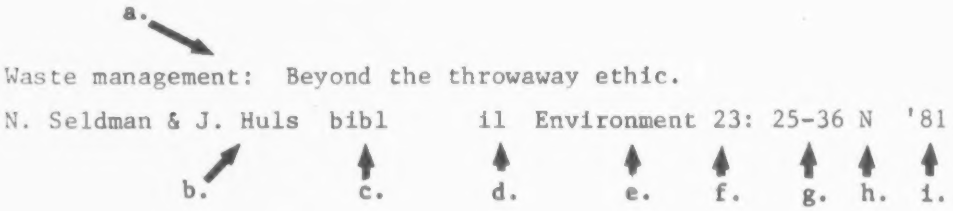
There are many other articles also listed under this heading. You might feel that this is great! It is, but don't stop there. You will often find further cross indexing aids under a particular heading. Using the example above, you would find the following suggestions (to mention a few) under the heading, "Refuse and refuse disposal."

See also:

Incineration
Refuse containers
Waste disposal in the ocean
Water pollution

If you were to look under each of these new headings, you would quite possibly find a number of articles pertaining to the topic you are investigating.

(II-14) Looking Back at The Readers' Guide. Let's see what you remember in terms of the written material and symbols used in The Readers' Guide. Below, you find repeated one of the references listed above. Fill in the blanks with the appropriate information and ask your instructor to check your responses.



Waste management: Beyond the throwaway ethic.
N. Seldman & J. Huls bibl il Environment 23: 25-36 N '81

a. ______________________________
b. ______________________________
c. ______________________________
d. ______________________________
e. ______________________________
f. ______________________________
g. ______________________________
h. ______________________________
i. ______________________________

Researching for Keeps: An Example

How you go about the task of doing research using secondary sources is largely determined by the topic, the questions needing answers, and your knowledge and skill as a researcher. What follows is an example of a research report completed by a student on the topic of polar bears. The major question posed by this research deals with whether the polar bear is an endangered species. Other, minor questions have also been answered via this research, e.g., what is the life cycle of the polar bear?

The writers are presenting this report as a model but they also want you to think critically about the quality of the research report and the bibliography at the end. You will be asked to complete a few tasks relative to it when you have finished reading the report.

THE POLAR BEAR: AN ENDANGERED SPECIES?

Are polar bears an endangered species? Should we be concerned about the conservation of these animals? Is it already too late? Is anything being done today to protect the polar bear? Before we attempt to answer these questions intelligently, we should first look at the general characteristics of the polar bear and some of the known facts about this species.

Thalarctos maritimus is the scientific name for the polar bear. This name means "sea bear". The name is quite appropriate as the polar bear is an excellent swimmer. Its color usually varies from a light yellow to a creamy white. A full grown bear may be up to nine feet tall (when standing on its hind legs) and weighs up to 1600 pounds. However, the average weight is about 900 pounds.

The polar bear usually hunts over a large area unless there is a suitable amount of food available in a small area (e.g., a dead whale up on the shore). This mammal is perfectly willing to act as a scavenger at these times but the polar bear is usually thought of as a meat eating predator, at least during the winter months. Its carnivorous diet consists mostly of seals, baby walruses, stranded whales, fish, and occasionally lemmings and mice.

Near July, when many of the icebergs have melted, the polar bear changes its carnivorous diet to one that is mostly vegetarian. It now seeks grasses, sedges, sorrel, seaweed, and berries. During these warmer months, the polar bear also hunts lemmings, eider ducks and snow geese. Although they may not always capture their prey, the bear will often feed on the eggs of ducks and geese.

The life expectancy of the polar bear varies greatly. At Regent's Park Zoo in London, a polar bear lived for some 40 years. However, the life span of such a bear in the Arctic is usually much shorter.

The female polar bear becomes sexually mature at the age of four. She almost always mates in April, but does so only once every three or four years. When winter approaches, the pregnant polar bear digs a den in which to have her cubs. The gestation period is nine months. Most cubs are born in early December. If this is the first offspring of the sow (the female bear), it will often be a single cub. After the first birth, the sow almost always has twins and occasionally triplets.

Cubs are usually blind, lack fur, and are deaf at the time of birth. Newborn babies weigh about two pounds and are approximately ten inches long. Sometime in March or April, the sow digs the way out of their den. The cubs are partially weaned by mid-July. At this time, they feed on seals killed by their mother. Until they learn to kill bigger game, their diet is supplemented only by crabs, shellfish, and seaweed. The cubs must be nurtured 18 months after birth in order to survive. They may weigh close to 400 pounds when their mother leaves them to fend for themselves.

Polar bears remain a great mystery to man. This is due to the fact that there is little research data regarding the natural history of this bear. Research is hampered by adverse weather conditions and the lack of tracking methods for following these wandering animals.

The first actual field work was accomplished by C. R. Harrington of the Canadian Wildlife Service in 1961. The Manitoba and Ontario governments followed with aerial surveys respectively in 1962 and 1963. Worldwide attention then began focusing on the plight of the polar bear. In 1965, the First

ENDANGERED HECK! I'LL BE GLAD WHEN THEY'RE EXTINCT!

International Scientific Meeting on the Polar Bear was held in Fairbanks, Alaska. This meeting was attended by the five polar bear countries concerned about the polar bear (i.e., Canada, Denmark, Norway, U.S.S.R., and the U.S.A.). At this meeting, these nations discussed protection of cubs and females, cooperation on research, and the need for an expanded study program. More extensive research has since begun and has improved considerabl by immobilizing the bears with a harmless drug shot from a gun. After the bears are immobilized, they are tagged and studied in detail.

Although far from complete, research has indicated some interesting points. People had generally accepted the idea that polar bears wander over the entire polar region. However, preliminary evidence from "tagged" bears suggests that the polar bear is not circumpolar. There may also be separate regional races of bears. If this is found to be correct, each interpolar country could manage its own polar bear population. Another interesting and alarming aspect about the polar bear is that they have been found with traces of DDT and other pesticides in their bodies - thousands of miles from where these chemicals had originally been used.

Many important questions remain unanswered. Scientists still do not fully understand how polar bears can survive in temperatures as low as -65 degrees F. Nor do they thoroughly understand the movements of the bears throughout the year, the longevity of bears in the wild, the distinctness of bear populations, or even how many polar bears there are remaining in the world. The origin of the bear population off the northeast Alaska coast is still a mystery because no large maternity-denning areas have yet been located in Alaska.

The polar bear appears to have many enemies with which to contend. They can suffer from foot infections, broken bones, arthritis, and even tooth decay in older individuals. A hungry bear will sometimes kill another bear for food. Wolves and large walruses kill a few polar bears each year. Slowly, over a long period of time,the arctic temperature has become warmer and this may be shrinking the polar bear's habitat.

At the top of the polar bear's enemy list is man. Due to increases in population and the demand for more power and natural resources, man is being forced to explore and develop that part of the world which was once the kingdom of the polar bear. Seal hunters make serious inroads on the polar bear's food supply. And, as seal supplies diminish, many hunters turned to killing the polar bear. High prices on polar bear skins, trophy hunters, and tourist-trade-hungry countries worsened the polar bear's population plight. In fact, between the years of 1940 and 1971 the number of bears killed increased from 148 per year to well over 1300 per year.

Wildlife biologists and conservationists fear that the polar bear is in real danger of becoming extinct. It is estimated that there are only between 5000 and 20,000 polar bears alive in the world today. If the number of kills was allowed to increase, the polar bear could become extinct in a relatively short period of time. It must be remembered that the reproductive capacity of the bear is extremely limited. There is no way that polar bears can increase their reproduction at the same rate that hunting pressure is increased.

The five polar countries concerned with this problem have made varying degrees of effort producing laws pertaining to the hunting of the polar bear. In 1956, the U.S.S.R. banned all hunting of the polar bear. Recently, set guns and trophy hunting were banned in Canada. The international Union for Conservation of Nature and Natural Resources, located in Switzerland, had placed the polar bear in its "Red Data Book" (a widely recognized official list of the world's rare and endangered species). The United States' two most influential hunting groups, the Boone and Crockett Club and the National Rifle Association, no longer offer awards of recognition for the shooting of a polar bear. No hunting of polar bears by whites is allowed in Manitoba. However, the Eskimos now have snowmobiles and are able to hunt these bears more efficiently. Possibly the reason for these different laws is the overall uncertainty of the polar bear population and its natural history. It now appears that the polar bears of Labrador may be almost extinct. Only on the west coast of Hudson Bay do they seem to be on the increase.

The conservation and/or management of a natural resource refers to the wise use of that resource. The safe extent to which polar bears can be hunted appears to be a very real problem.

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Carter, J. O. "Polar Bear the Hard Way," Outdoor Life, (June 1982) 64-66+.

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Fadiman, A. "The Great White Bears," Life. (February 1984) 42-46+.

Golden, F. and Ogle, E. "Plethora of Polar Bears," Time. (December 21, 1981) 70-71.

Guravich, D. "King of the Arctic," Popular Photography. (May 1984) 77+.

Larsen, T. "We've Saved the Ice Bear," International Wildlife. (July-August 1984) 4-11.

Lentfer, J. W. "Solitary Sea Bear: Management of a Threatened Species, Polar Bears," Oceans. (September 1979) 49-54.

"Polar Bears: Fussy Giants of the Far North," National Geographic World. (February 1978) 6-9.

II-15. Analyzing the Research Report

1. The writer of the research reports that a young polar bear weighs up to 400 pounds when it is weaned by its mother. Other references, however, state the weight at 200 pounds. How might the writer have checked this conflicting information? Of course, he might have decided to write for expert information. Where might this letter be sent?

2. In the first paragraph of the research report, the writer asked whether it was too late to save the polar bear from extinction. Yet, he didn't answer that question in the report. Why? ________

3. Is there any indication in the research report on polar bears as to what the writer's own values are concerning the management of this animal?

Yes ____ No ____ If so, where? ________

4. Do you believe that the person who researched the management of polar bears did a good, thorough job? Yes ____ No ____. Cite evidence to support your own position on this. ________

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS:
SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

MODULE II

GETTING STARTED ON ISSUE INVESTIGATION

Objectives for Module II

Overview:

In Module II, students are first given a set of experiences in classifying environmental issues as local, regional, national or international and in defending the classification schemes they create. They are then introduced to first hand and secondary sources of information and classify issues in terms of the type of investigation (primary or secondary) which will produce the best information on those issues. Students next develop logical and pertinent questions to be asked regarding specific environmental issues. Students are introduced to periodicals, agencies, and examples of community resource people which are valuable in obtaining information concerning environmental issues. Students compare secondary sources to identify how they may differ from each other, identify governmental or private agencies to which they can write for information, write letters requesting information, identify and communicate two or more value positions expressed by environmental news articles, write a succinct summary of an environmentally related article, and locate three valid references for an environmental problem of their choosing. Further, they are introduced to the skills needed for the successful use of the library, i.e., the card catalog, The Reader's Guide, the Dewey Decimal System, and cross indexing. Finally, students are presented with a written research report which serves as a model and are asked to analyze that report.

Specific Objectives: As a function of Module II, students will be expected to be able to . . .

1. . . .using information concerning the skill of classification, accurately group fifteen environmental issues into each of three assigned categories.

2. . . .logically defend a portion of the classification scheme produced as the result of Objective 1.

3. . . .using information about ways of investigating environmental problems, reclassify the original issues in terms of how they can be attacked for study.

4. . . .after reading a description of an environmental issue, correctly identify problem questions that apply to that situation from a list presented to you.

5. . . .after reading a description of an environmental issue, identify and communicate problem questions that are consistent with that issue.

6. . . .compare two information sources about coal reserves, identify the important data (information, values, value positions) in each source and communicate how these data differ.

7. . . .identify governmental or private agencies to which you can write for specific information about an environmental issue.

8. . . .write a sample letter to an agency asking for information about a particular environmental issue. The letter is to be correct in terms of its general structure, the agency chosen to be contacted, and the kinds of information requested.

9. . . .read two environmental news articles and state at least two differing value positions as expressed in each article.

10. . . .locate and read one environmentally-related article approved by your instructor and write a brief summary which accurately communicates the main point(s) presented.

11. . . .choose an environmental issue, locate three good references concerning this problem, and correctly list these in written form.

12. . . .correctly identify the written information (and symbols) used on a card from the card catalog.

13. . . .correctly identify the written information (and symbols) used in a reference from The Reader's Guide.

14. . . .analyze a research report dealing with polar bear management and . . .

    A. cite one source of information to which the author might have written for more information.

    B. explain why the author was unable to answer one of the questions asked in the report.

    C. determine if the author's values toward polar bear management are reflected in the report and, if they are stated or inferred, identify where this information is located.

    D. state specifically why you consider (or do not consider) the research report to be a good, thorough job of covering the subject.

Suggestions for Teaching Module II

Module II introduces the student to an array of strategies he will find extremely useful in researching environmental issues using secondary sources. Locating, analyzing, and using information sources are the key elements in this module. At first glance, most of the objectives deal rather specifically with language arts skills. Even though this module emphasizes language arts skills, these processes are totally developed around environmental topics. Thus, one of the more prominent challenges of education is met squarely in this module - the integration of content. Aside from this highly desirable aspect of Module II, students are again exposed to a wide array of environmental issues, ranging from energy production to polar bear management. A good deal of conceptual content is subtly infused into the module making it attractive for teaching environmental education.

EXERCISES II - 1, 2, 3 and 4 (pages 38, 39-40, 41, 43-SM) engage the students in tasks requiring the skill of classification and the defense of classification schemes for environmental issues. Classification is man's way of organizing information into useful cognitive packets. It is arbitrary and, although this process follows particular rules for particular subject matter, it is simply a means for grouping objects and/or events having similar properties. In these modular exercises students are asked to classify environmental issues in two ways and to defend one of them.

In EXERCISE II-1 issues are identified and classified as being local, regional and national (or international) in importance. In EXERCISE II-2, this same classification is repeated but more extensively since students must use various information sources and generate four issues under each classification. It is important for the instructor to stress that the issues be stated very specifically and communicated very clearly. It might be valuable to construct a total listing for the entire class. Students can then critique the listing for both valid classification and specificity and clarity of the issues. They can also observe the overlap of many issues which can validly fit more than one heading. The chart can later be used as a reference (idea bank) as students seek topics for autonomous investigation or other activities in Modules II-IV.

In EXERCISE II-3 students select one issue from each of the categories they generated in the previous exercise and defend their categorization. The rationale for this task is simple. Students who are not sophisticated in thinking about issues in the environment will likely perceive that they are all similar in many dimensions. Similarly, it is possible that they may feel that the environmental issues around them are strictly "someone else's business" and none of their own. Or conversely, they may perceive only local issues and fail to intellectually acknowledge issues at a national or international level. This exercise aids in expanding this conceptualization. Similarly, it shows a classification scheme at work and demands that the student defend the rationale used.

In EXERCISE II-4, students determine whether issues can be investigated using first-hand sources, secondary sources, or a combination of sources by reclassifying the fifteen issues identified in Exercises II-1 and II-2 accordingly. This final classification task is a most pragmatic one in that it is prerequisite to the remaining tasks in Module II. Although the student is not forced to defend this particular classification scheme, it is highly recommended that the instructor pay close attention to how the student classifies his/her problems and ask for a defense if there is any question about achievement on the task.

EXERCISE II-5 (page 48-SM) requires students to analyze questions about a historic environmental problem. The rationale for this activity rests with the following argument: If a human being perceives an environmental problem situation and cannot critically diagnose that problem in terms of questions that need to be asked, that individual's capability is markedly reduced. Exercise II-5 is a comprehension-synthesis level task and demands both critical reading and critical thought. The student is asked to read a passage concerning deer management in Pennsylvania in the early 20th Century (pages 45-47-SM) and then respond to a list of six questions in terms of whether they logically fit the narrative.

The list of six questions to which the student responds is not a trite one. The questions are pertinent questions in dealing with wildlife management. Each of the six is actually related to the historical narrative and all should receive an "X" by the student. It is doubtful that many students will find this a simple task, but, for those who do, the instructor may wish to ask them to return to the narrative and attempt to identify other questions having bearing on the passage.

EXERCISE II-6 (pages 49-50-SM) requires the student to write pertinent questions for an environmental problem situation. If the student is to become an autonomous learner, he or she must be able to do more than indicate whether a particular question fits a particular environmental problem situation, i.e., Exercise II-5. The student is asked to read a new problem situation in Exercise II-6 and identify and write out those questions pertaining to it. The narrative for Exercise II-6 deals with the issue of goose-hunting in the Bosque del Apache National Wildlife Refuge in New Mexico (page 49-SM). At the end of the passage the student finds a worksheet on which to state the questions he/she thinks are appropriate. One example is given to the student as a model.

Several appropriate questions can be generated for this environmental problem situation. Among them are:

1. Does the goose hunting on the refuge interfere with the pair bonding of the whooping crane?

2. Should something other than lead shot be used by hunters on and near the Bosque del Apache National Wildlife Refuge?

3. Would it help the whooping crane population to prohibit goose hunting on those refuge areas inhabited by whooping cranes?

4. How would resident waterfowl hunters react if hunting was discontinued on or near the Bosque del Apache National Wildlife Refuge?

If the instructor finds that students are having a difficult time writing questions for the passage in question he/she should make out a worksheet similar to that for II-5 using the four questions noted above. This worksheet could then be distributed to students and acted on in a manner similar to the instructions for II-5. If this is done, however, it is recommended that the instructor add two or three incorrect questions to the list. Following this, the instructor should do II-6 using an entirely different narrative, one of his own choosing. Other possible topics for a narrative of this type are: Lake Erie, the American bison (buffalo), the Aswan Dam (Egypt), Great Plains Dustbowl, the passenger pigeon, and the super-sonic transport (SST). Every effort should be made to bring students to criterion on this task.

EXERCISE II-7, (pages 55-58-SM) focuses on getting the student to realize that he must approach references dealing with environmental issues cautiously. The fact that many references deal with very specific environmental biases makes this activity extremely important for the student. Just what should a person believe? What biases are present? Why is the author biased in the manner reflected in the article, pamphlet, etc.? How can a person check the validity of the information given? These are all points to consider in dealing with the information and tasks associated with II-7.

Correct responses are given to the student upon completion of the first two sections of II-7. The third task merely asks the student to compare a new reference with the initial reference. Data presented can be checked against data given the student on page 56-SM. More importantly, the teacher should stress how different the two sources are and possible reasons for these differences.

EXERCISE II-8, (pages 58-59-SM) involves the students in the short but important task of determining where to write for information concerning 1) timber harvests in national forests and 2) values which operate to keep the world's population from reaching zero. Appropriate responses for the first part of II-8 include The American Forestry Association and the U.S. Forest Service. Responses for the second task include Planned Parenthood and Zero Population Growth. This written activity, although important, is probably far less important than the rules expressed for letter writing activities presented in the next section.

EXERCISE II-9, (page 62-SM) requires the student to write a practice letter which requests information on an environmental topic. The instructor is encouraged to reinforce the rules stated in this module concerning the writing of letters for information. Summarized, they may be listed as follows:

1. Choose an appropriate source to which to write.

2. Be very specific in the request for information.

3. Use proper form, grammar and punctuation.

This exercise gives the instructor an opportunity to evaluate the student's letters. It is highly recommended that the teacher be rigorous in his/her evaluation of these practice letters. A poor model at this time will not guarantee good letter-writing skills when applied in a real situation. You may find that your students will require specific instruction in letter writing. Do not hesitate to do so or to team up with the language arts teacher in order to accomplish this.

Although no activity is suggested for interviewing local resource people in this section (pages 62-63-SM), feel free to create your own. The students might be assigned a specific topic and instructed to name two or three pertinent resource people. A role-playing situation between interviewer and interviewee would also seem an appropriate extension. The class might then critique the session in terms of appropriate interview procedures. Telephone protocol might be another discussion/activity topic.

EXERCISE II-10, (pages 63-66-SM), once again, takes a look at values in relation to printed information. In the examples used, alternate value positions are stated or inferred. Students are asked to identify these value positions in two separate news articles. This activity not only reinforces the students' perspectives of values but it also helps get them ready to begin reading and summarizing articles concerning environmental issues. And, it is often critically important for a summary to capture accurately the value position(s) of the writer(s). Further, it is hoped that the student has begun to perceive the necessity for reading critically, particularly in the context of bias or values. This activity bears repeating if you have available divergent articles on the same issues. Perhaps there is a local or state environmental issue occurring in your area which is being covered in the local papers.

EXERCISE II-11, (page 68-SM), has the student write a summary of an article approved by the instructor. This task gives the student practice in summarizing a printed article and forces him/her to take a hard look at his/her summary from several standpoints. It is somewhat questionable whether this one summarizing assignment will give the student expertise in this skill (or set of skills). The instructor may well decide to have students summarize an additional article after the initial effort has been evaluated. If this is the case, it is further suggested that the instructor find one or two succinct but excellent articles, reproduce them, and use these for this assignment. This will permit closer scrutiny of the product.

LIBRARY RESEARCH EXERCISE II-12, (page 70-SM), finds the student searching for three references concerning a particular topic and putting them into a standard bibliographic format. Some educators would question doing this exercise before giving the students an introduction to library skills. However, the task is placed here for a reason. It is hoped that the student will experience at least a minimum of frustration in the completion of this assignment. Although not a strategy used often enough in the classroom, students learn much better when they perceive the need! Subsequent library skills should be developed better as a function of some frustration with Exercise II-2. However, the task in Exercise II-12 is an important one in its own right and should be completed. It is further recommended that Exercise II-12 be repeated at the end of Module II as an evaluation of the extent to which students have acquired the library skills in Exercises II-13 and II-14.

Pages 72-74-SM introduce the student to the card catalog. The three main types of cards found in the card catalog and the information found on these cards are identified. The Dewey Decimal System is also outlined.

EXERCISE II-13, (page 75-SM) calls for the student to recognize a title card, state where in this library this particular title will be found, and identify the specific information found on a title card. If the student achieves criterion on this task, one might feel confident about the student's understanding of catalog cards.

A trip to the library and actual contact with the card catalog is crucial. Topics should be assigned students to look for after the card catalog is reviewed in the library itself. A few possible topics follow:

Subjects

air (air pollution)
Alaska
bison (buffalo)
coal mining
conservation
ecology
energy
mammals
national parks
noise (noise pollution)
nuclear (nuclear energy)
pesticides
population
prairie
river
soil
swamps
waste (waste disposal)
water (water pollution)
wolf (wolves)

Authors

Myron Sutton
Rachel Carson
Marston Bates
Roger Tory Peterson
David F. Costello
John Maddox
Barry Commoner
John H. Storer
John W. Gardner
Fairfield Osborn
Peter Farb
Durward L. Allen
Steward L. Udall
Willy Ley
Garrett Hardin
Rene Dubos
Paul R. Ehrlich
Lester Brown

If your school library is inadequate or non-existent, a field trip to the high school center or the public library is suggested.

Pages 75-77-SM approach the topic of The Reader's Guide in much the same manner as the card catalog. It is explained and specific examples with their associated symbols are given. Cross indexing and its value are introduced. This section closes with EXERCISE II-14 (page 78-SM) which calls for the student to identify the information and symbols used on a specific reference from The Reader's Guide.

Again, it is strongly recommended that The Reader's Guide be studied in the library itself. It is a tremendously valuable tool in doing library research and the student who does not feel comfortable with it could wander aimlessly, accomplishing little.

It is further recommended that topics be given the students for practice in using The Reader's Guide. Similarly, the instructor may wish to evaluate the students in more detail than EXERCISE II-14. This should be considered appropriate, particularly if Exercise II-14 is completed before the students go to the library to investigate The Reader's Guide and/or if they did not achieve criterion on Exercise II-14.

Pages 79-83-SM present a research report entitled "The Polar Bear: An Endangered Species?". This research report is presented as one example of the type of product made possible by using secondary sources. It can be also used by the students as a reference during Module V.

EXERCISE II-15, (page 84-SM) requires the student to analyze the polar bear research report. The topic of the polar bears is one having considerable interest for middle school students so motivation for reading is little problem. However, Exercise II-15 asks some pointed questions about the report which may demand that the student go back and do some critical reading. Appropriate repsonses for Exercise II-15 follows.

1. American Museum of Natural History
   National Wildlife Association

2. The particular question referred to by the student cannot be answered simply because no one knows for sure at this time.

3. The author's values concerning polar bear management are largely inferred from the title and the first and last paragraphs of the report. (It is suggested that, during class discussion of this particular assignment, students attempt to interpret what the author's values are. Further, the instructor can theoretically place the author in fictional situations and ask the class how we would probably behave in those situations, e.g., the writer is invited to go to Labrador and hunt polar bears for their skins).

4. There is no one right or wrong answer here as it depends upon the reader's perceptions concerning the quality of the work. However, it is important for the student to adequately defend his position whichever way he chooses to respond.

Again, the authors of this module suggest repeating Exercise II-12 (page 70-SM) at this time unless the students appear to have a thorough grasp of how to use the library. If repeated, students should probably research a topic different from that researched the first time Exercise II-12 was completed.

MODULE III

USING SURVEYS, QUESTIONNAIRES, AND OPINIONNAIRES IN ENVIRONMENTAL INVESTIGATIONS

Introduction

Several different research methods can be used to study environmental issues on a first-hand basis. Three of these methods are surveys, questionnaires, and opinionnaires. In this module you will be introduced to each of these. You will study the rules governing the use of surveys and questionnaires. You will learn to distinguish between the three research methods introduced in this module. Most important of all, you will probably get a chance to do research using at least one of these methods. You should find this interesting so let's get started.

Objectives for Module III

Upon the completion of Module III you will be expected to be able to . . .

III-1. . . . name several environmental issues which lend themselves to gathering information using surveys.

III-2. . . . name several environmental issues which lend themselves to gathering information using questionnaires.

III-3. . . . name several environmental issues which lend themselves to gathering information using opinionnaires.

III-4. . . . prepare a list of rules that should be respected when developing surveys, questionnaires, or opinionnaires.

III-5. . . . identify, from a list of 10 research questions, those items which are basically surveys, those which are questionnaires, and those which are opinionnaires.

III-6. . . . explain why studies done using questionnaires or opinionnaires are really special kinds of surveys.

III-7. . . . identify an issue of local concern and make a list of the information that needs to be collected during an investigation of that issue.

III-8. . . . plan for and conduct a research study which focuses on the use of a survey, questionnaire, or opinionnaire. In addition, successfully communicate the data collected during that research.

Surveys

A survey is one method that can be used to collect information about certain environmental problems. The survey can be a direct means of investigating something in or near your community. How valuable it will be depends entirely on how you go about it and the quality of the data you collect.

A survey collects information. In the dictionary you will find a definition for SURVEY something like the following:

> SURVEY: A critical inspection used to provide exact information. Often, a study of an area with respect to certain conditions.

This simply means that a survey looks for very specific information in a very particular area. The key words seem to be INFORMATION and AREA. Consider the following survey examples:

1. The number of leaky faucets in a given school building.
2. The number of empty junior high school classrooms in which the lights have been left on during the day.
3. The amount of fast food litter within a four block radius of a local fast food restaurant.
4. The number of cars coming to the junior high school each morning with only one student passenger.
5. The number of returnable and non-returnable beverage containers sold in a local grocery store.
6. The temperature (in Fahrenheit) at which local home owners keep thermostats during the month of January.
7. The amount of food wasted in a one week period in the school cafeteria.

Did you note in each of the examples WHAT is being surveyed and WHERE the survey is to take place? You should be ready to think of some environmental conditions that YOU could survey. Try your hand at listing two good environmental surveys in the spaces that follow. (III-1)

1. ______________________________

______________________________.

2. ______________________________

______________________________.

You are now ready to examine a model survey. This survey includes (1) the research questions, (2) the survey procedures, (3) a data grid, and (4) a summary analysis sheet. This package represents all the necessary components to successfully compile information about an environmental problem (or a suspected problem). The research questions specify exactly what information is to be examined. The data grid is a method of accurately recording that information. The summary analysis sheet organizes the results of the survey.

MODEL SURVEY

A Neighborhood or School Survey of Trees and Shrubs

Survey (Research) Questions:

1. How many trees and shrubs exist in a given block or on the school site?
2. Where are these trees and shrubs located?
3. What kinds of trees and shrubs have been planted here?

Survey Procedures:

1. Carefully choose the block, neighborhood, or school site to be surveyed.
2. Plot the locations of trees and shrubs using the Survey Grid found on the next page.

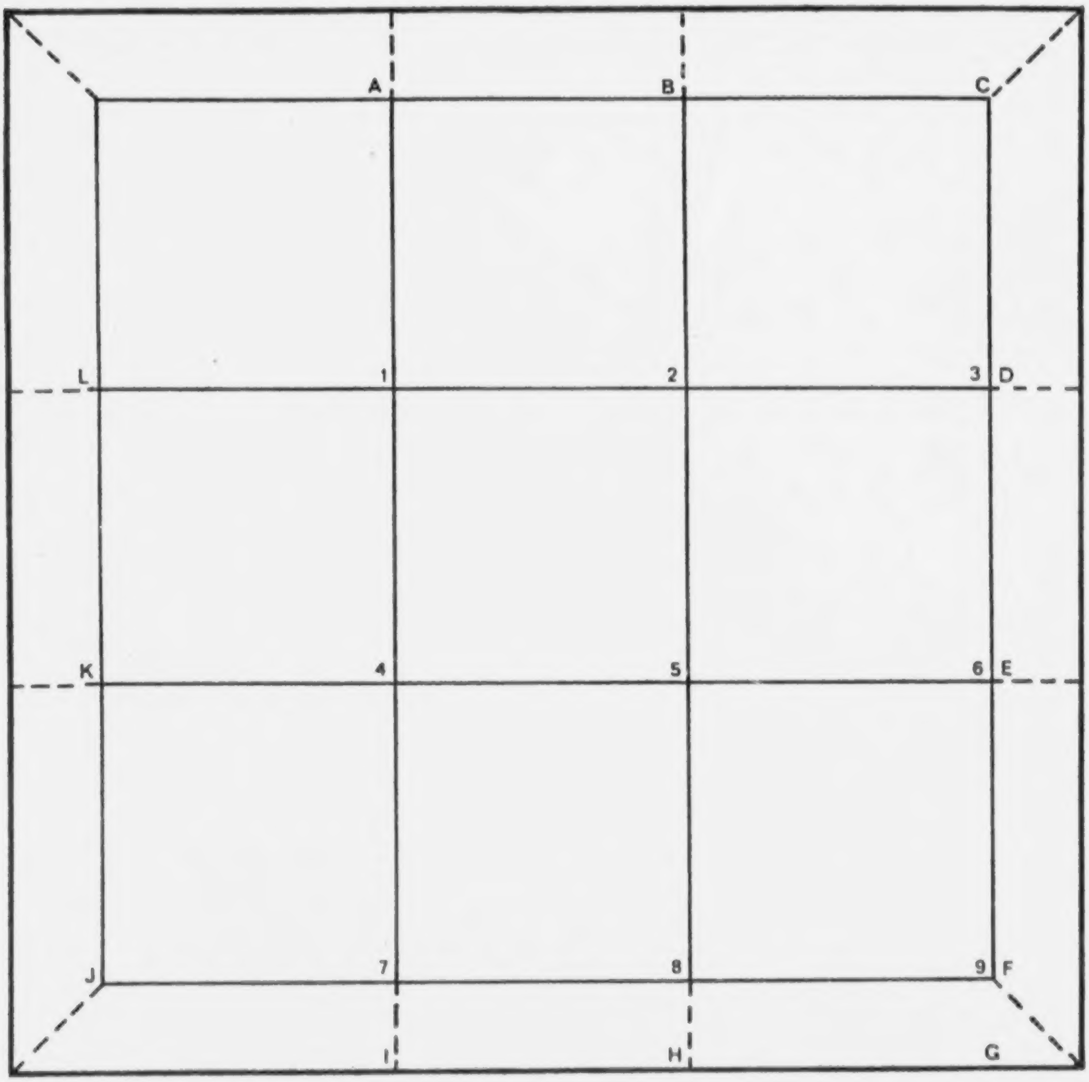
   (Note: You should make certain that the dimensions of your grid correspond to the area chosen for the survey. The grid provides for a square block and shows curb strips. This may or may not be suitable for your purposes. Symbols can be used for various kinds of trees and shrubs and suggested symbols are found at the bottom of the page on which is located the Survey Grid.)
3. Record the data collected on the Data Summary Sheet. If this Data Summary Sheet does not meet your needs, design a new one.
4. Carefully consider the implications that this kind of survey could have on a neighborhood, on a school site, or on wildlife populations. That is, of what value could such a survey be?

Neighborhood Survey Grid - Data Sheet

Exact site of survey: ______________________________

____

Date of survey: ______________________________


A
B
C
L
1
2
3
D
K
4
5
6
E
J
7
8
9
F
I
H
G

SYMBOLS:

X = ____________ # = ____________ S = ____________

+ = ____________ θ = ____________ V = ____________

0 = ____________ * = ____________ Z = ____________

DATA SUMMARY SHEET

Survey of Trees and Shrubs

	Kinds of Trees and Shrubs																	
Grid Component - Read Down!																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
A																		
B																		
C																		
D																		
E																		
F																		
G																		
H																		
I																		
J																		
K																		
L																		
Sub Totals																		

Total Trees Present = ______

Total Shrubs Present = ______

Questionnaires

A questionnaire is a special kind of survey. It can be used to collect information that can only be obtained in this manner. A definition can be found below.

> QUESTIONNAIRE: A carefully written set of questions about a particular subject that is given to a carefully selected population of human beings.

It is critical to note that questionnaires collect only hard, cold data (i.e., facts). They do not collect opinions people have about something. Consider the examples below.

1. Family size in a particular neighborhood or community.
2. Number of gasoline powered devices owned per family in a neighborhood or community.
3. Types of heating systems found in a particular neighborhood or community, e.g., natural gas, bottle gas, fuel oil, coal, wood.
4. Garbage disposal techniques used by renters and/or home owners.
5. Number of home owners recycling metal and/or glass containers.
6. Average number of pets being fed by residents in a particular neighborhood or community.

Can you think of two other topics of an environmental nature that could be studied using a questionnaire? Remember to specify the particular subject topic and identify the target population. (III-2)

1. ____

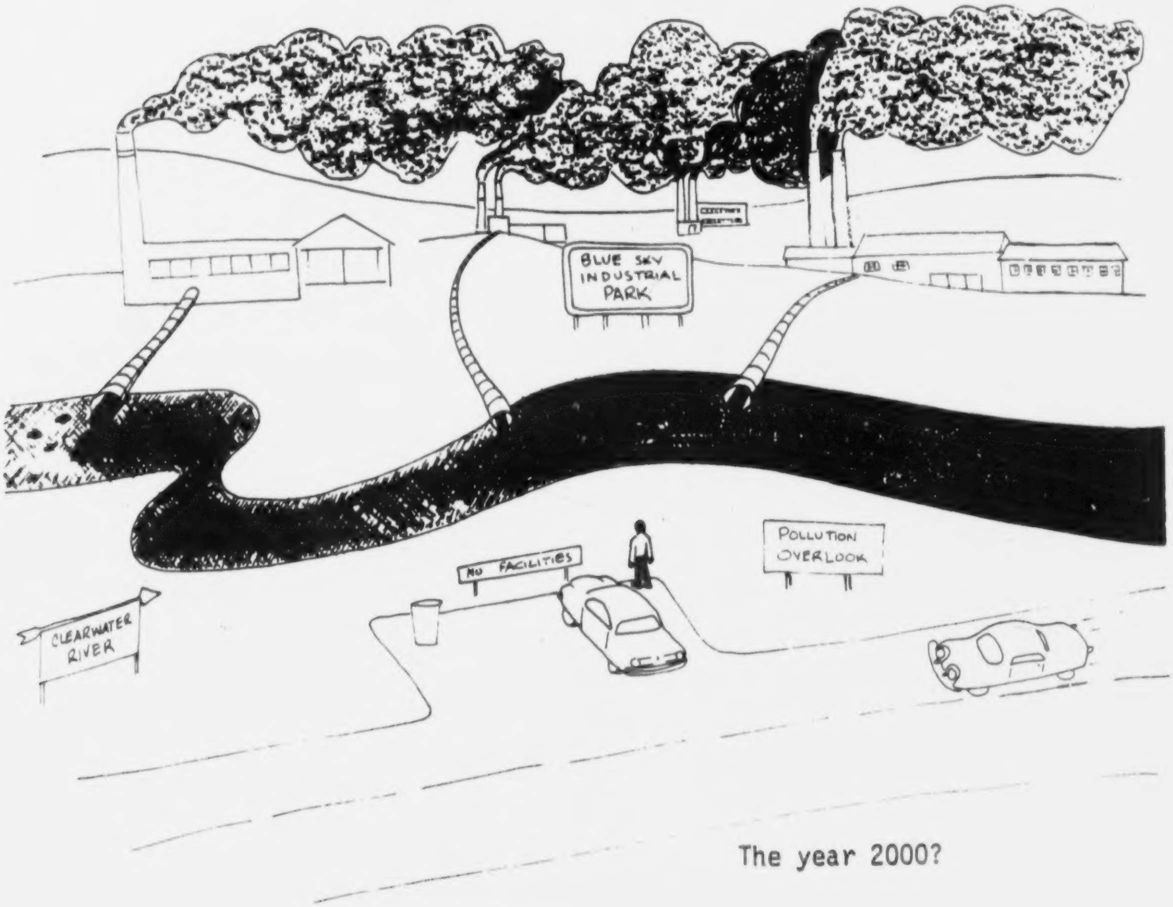
____.

2. ____

____.

A questionnaire is a special kind of survey. It requires information that can only be supplied by human beings. Thus, each research question for a questionnaire must specify a target population. Reread each of your responses to make sure both the TOPIC and the TARGET POPULATION are included.

Now, please examine the model questionnaire and its data summary sheet that follow.


BLUE SKY INDUSTRIAL PARK
NO FACILITIES
POLLUTION OVERLOOK
CLEARWATER RIVER

The year 2000?

MODEL QUESTIONNAIRE

Glass and Metal Waste Questionnaire

This questionnaire is designed to yield usable data concerning the habits people have developed relative to their use and disposal of glass and metal containers. It should be used with a member of a household, preferably the person responsible for household management. If this questionnaire is used, the size of the sample gathered should be fairly large in order to make the data meaningful, i.e., over 50 responses. Similarly, it is suggested that data be collected and categorized (tabulated) according to particular parts of the community, i.e., high income, middle income, and low income neighborhoods.

+ + + + + + + + + + +

Hello, my name is ________________. I am a student at ________________ school. One of my classes is doing research in environmental problems and I would like to ask you a few questions about your use of glass and metal containers. May I ask you a few questions?

Person responding: Male ___ Female ___.

Address: ____.

1. How many people live in this household? ____________
2. Do you purchase any part of your groceries (other than beverages like pop, fruit juice, or beer) in metal containers? Yes ___ No ___
3. Do you purchase any of your beverages in metal containers? Yes ___ No ___
4. Do you purchase any beverages in glass containers? Yes ___ No ___
5. Of those beverages purchased in glass containers, what percent of the beverages are in returnable glass containers? _____ %
6. Regarding metal cans, what percent of them do you take to a local recycling or collection center? _____ %
7. Regarding throw-away glass containers, what percent of them do you take to a local recycling or collection center? _____ %
8. Have you (or any member of your family) ever asked your grocer to stock beverages only in reusable glass containers? Yes _____ No _____

THANK YOU VERY MUCH FOR YOUR HELP!

Glass and Metal Waste Questionnaire Data Summary Sheet

ITEM	Population or Neighborhood A.		Population or Neighborhood B.		Population or Neighborhood C.		TOTALS	
No. Males Responding								
No. Females Responding								
Average No. People per household								
Groceries (Not Beverages) Purchase in Metal Cans	Yes	No	Yes	No	Yes	No	Yes	No
Beverages Purchase in Metal Containers								
Beverages Purchase in Glass Containers								
% of glass reusable =								
% of glass throw-away =								
% of cans thrown away =								
% of cans recycled =								
% of throw-away glass thrown away =								
% of throw-away glass recycled =								
Has any member of the family ever requested grocer to stock only reusable containers?	Yes	No	Yes	No	Yes	No	Yes	No

Opinionnaires

Opinionnaires are like questionnaires except for one major difference. Opinionnaires measure OPINIONS or beliefs of human beings concerning specific things. Consider the following examples.

1. Should auto emissions be tested regularly by local or state governments?
2. Will legislation placing a deposit on beverage containers be supported by the public?
3. Should stricter controls be placed on the import of exotic animals to be sold in pet stores?
4. Are farmers in favor of economic incentives which would promote erosion reducing farming practices?
5. Do high school students believe that they contribute to air pollution in any way?
6. Do coal miners believe that acid rain causes important environmental damage?
7. Should the federal government assist citizens affected by toxic wastes?

You can easily see that all of the questions above deal with how people FEEL about something - or, their opinions about something. Now, let's see whether you have the idea. Think about local, regional, or national environmental issues about which you could get peoples' opinions. Write two of these below. (III-3)

1. ____

____.

2. ____

____.

Evaluate your questions to make sure they deal with peoples' opinions or beliefs. Then examine the model opinionnaire and the data summary sheet that follow. This example should improve your understanding of the nature of opinionnaires.

MODEL OPINIONNAIRE

Opinions on Littering

This opinionnaire is designed to collect information on the opinions citizens have concerning littering. It is suggested that samples be drawn from several segments of the population, e.g., junior high students, high school students, and adults. Data collected should be reported for specific samples. The opinionnaire is set up so that it should be read to the person being surveyed. A minimum of twenty-five (25) persons per sample is recommended.

+ + + + + + + + + + +

Hello, my name is ____________________________. I am a student at ______________________________ school. One of my classes is collecting information about how people feel about littering. May I collect information from you? (If the answer is "yes", continue.)

Person responding: Male _____; Female _____. Age of person responding: Junior High _____; Senior High _____; Adult _____.

Questions:

1. Do you consider the littering of public and/or private property to be a problem in this community? Yes _____; No _____; Undecided _____.

2. In your opinion, does littering have any harmful effects on the beauty or aesthetic quality of this community? Yes _____; No _____; Undecided _____.

3. In your opinion, does littering pose any public health problems for this community? Yes _____; No _____; Undecided _____.

4. In which of the following places in the community do you think littering is at its worst?

_____ A. The schools?
_____ B. The streets?
_____ C. Shopping centers?
_____ D. Other businesses like gas stations and drive-ins?
_____ E. Private property?

Continued . . .

5. What age person do you believe is the most responsible for littering?

_____ A. Students below junior high age?
_____ B. Students of junior and senior high age?
_____ C. College age citizens?
_____ D. Citizens over the age of 21?

6. Which of the following statements concerning law enforcement do you agree with MOST?

_____ A. Law enforcement officers should ignore people who litter.
_____ B. Law enforcement officers should enforce anti-littering laws only in cases of severe littering.
_____ C. Law enforcement officers should enforce anti-littering laws strictly - to the letter of the law.

7. Would you ever consider reporting a severe case of littering to the police? Yes _____; No _____.

8. Have you ever reported a severe case of littering to the police? Yes _____; No _____.

9. Do you wish that fewer people would litter? Yes _____; No _____; Undecided _____.

10. In your opinion, what do you feel is the most important reason for the litter problem as it exists today?

Response: ____

____

____

____

____.

THANK YOU FOR YOUR HELP!

END

LITTERING OPINIONNAIRE DATA SUMMARY SHEET

Sample Being Reported:
Junior High Sample: _____.
Senior High Sample: _____.
Adult Sample: _____.
Other: ________________.

Number In This Sample: ___________
Person(s) Collecting These Data:
____
____

Question 1. Yes: Males _____ Females _____ Total _____
No: Males _____ Females _____ Total _____
Undecided: Males _____ Females _____ Total _____

Question 2. Yes: Males _____ Females _____ Total _____
No: Males _____ Females _____ Total _____
Undecided: Males _____ Females _____ Total _____

Question 3. Yes: Males _____ Females _____ Total _____
No: Males _____ Females _____ Total _____
Undecided: Males _____ Females _____ Total _____

		Males	Females	Total
Question 4.	Response A:	_____	_____	_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____
	Response D:	_____	_____	_____
	Response E:	_____	_____	_____
Question 5.	Response A:	_____	_____	_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____
	Response D:	_____	_____	_____
Question 6.	Response A:	_____	_____	_____
	Response B:	_____	_____	_____
	Response C:	_____	_____	_____

Question 7. Yes: Males _____ Females _____ Total _____
No: Males _____ Females _____ Total _____

Question 8. Yes: Males _____ Females _____ Total _____
No: Males _____ Females _____ Total _____

Question 9. Yes: Males _____ Females _____ Total _____
No: Males _____ Females _____ Total _____
Undecided: Males _____ Females _____ Total _____

Question 10. Summary of Reasons: ______________________________

____

____

A Self-Test

After the introduction you have had to surveys, questionnaires, and opinionnaires you should have a fairly good idea of each. In this test you will find ten questions. Read each carefully. Place an S in front of the question if it represents a SURVEY, an O if it is an OPINIONNAIRE, and a Q if a QUESTIONNAIRE. (III-4)

_____ 1. How many acres of park space are set aside for each resident in this community?

_____ 2. Should wandering packs of dogs be allowed to roam the neighborhoods in this community?

_____ 3. Do the citizens of this community prefer having a tree and house decoration contest at Christmas (with lights) or would they prefer to conserve the electricity used in such an effort?

_____ 4. Do members of families in your community contribute to any conservation organizations? If yes, which organizations?

_____ 5. How many faucets in your school building drip water? How much water is lost (in gallons) per month or per year? What is the cost?

_____ 6. What type of refuse disposal does your community have, e.g., open dumps, sanitary landfills, controlled incineration, or some other?

_____ 7. If the rat population in your community increased, would citizens be willing to accept a tax increase in order to eliminate the rats?

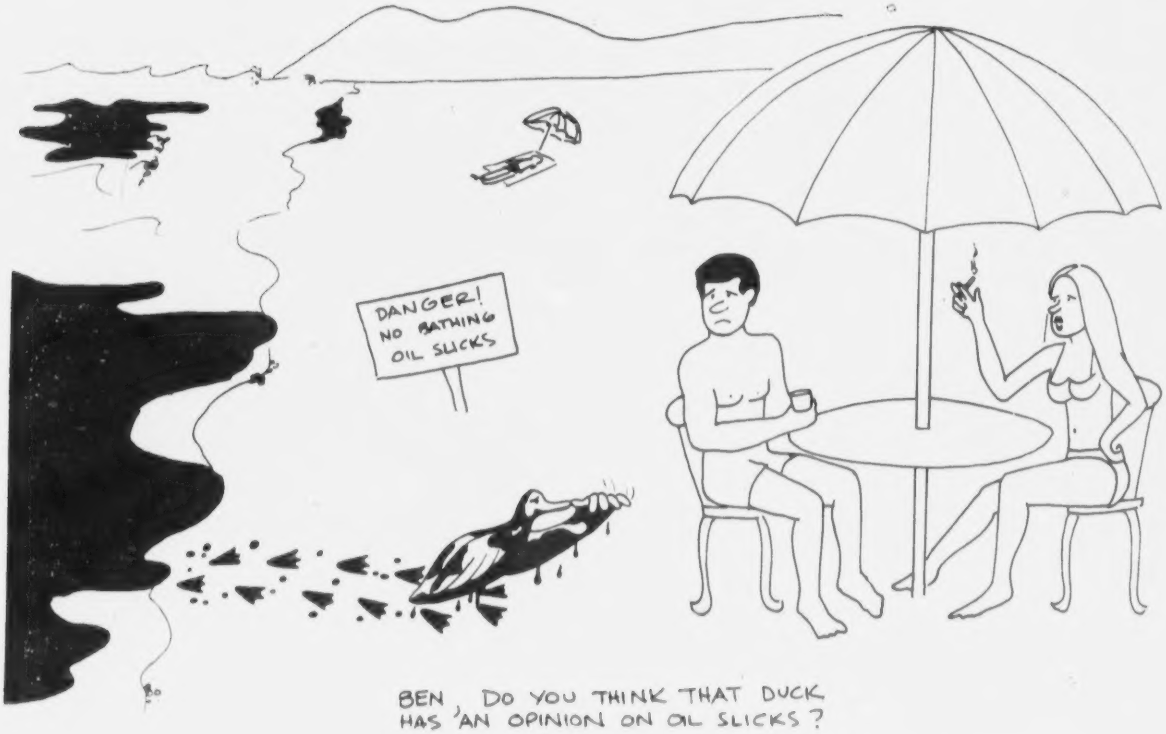
_____ 8. How many areas on the school grounds show signs of soil erosion? How many of these could be improved with the planting of ground cover?

_____ 9. Should the recycling of glass and metal waste be made mandatory even if it is currently unprofitable?

_____ 10. How much money is spent per month on pet food in your community?

Correct responses are found at the bottom of the page.

Correct responses: 1. a survey; 2. an opinionnaire; 3. also an opinionnaire; 4. a questionnaire; 5. a survey type question; 6. a survey; 7. the best answer here is an opinionnaire because this is asking for someone's attitude toward additional taxation; 8. a survey; 9. an opinionnaire; 10. a questionnaire. How well did you do? If you got nine out of ten your concepts are probably in pretty good shape.



BEN, DO YOU THINK THAT DUCK HAS AN OPINION ON OIL SLICKS?

Let's Summarize

A good way to investigate environmental issues is to collect information with surveys. Surveys are aimed at a specific kind of information in a certain area. Sometimes information can only be obtained from human beings. A questionnaire is a survey asking human beings for information. An opinionnaire is a survey asking for human beliefs and opinions.

Since you have been introduced to surveys, questionnaires, and opinionnaires it is time to practice using them. Your task for this part of the module is to work as a class to plan, write, and use one type of survey, i.e., a survey, questionnaire, or opinionnaire. The teacher, along with you and your classmates, may choose to use one of the survey models presented earlier. However, it is possible that an entirely new one will be developed.

First, it is necessary to discuss a limitation of this module. This module will help you set up and use your survey to collect data. But that is only part of the task. Another part is to interpret the findings (i.e., the data). The process of data interpretation will be presented in Module IV. The thrust of this part of Module III will be to collect good data for interpretation.

Your first task is to assist your instructor and your classmates in choosing a LOCAL environmental ISSUE for investigation. For example, you might think that the fast food restaurant litter is a local problem. Because this is a practice activity, make your choice simple and straightforward. Write your choice for a local environmental issue to be investigated below.

My choice for investigation: ______________________________

____

____

____.

Now consider your environmental issue. Specify exactly what it is you want to find out about that issue. For the fast food litter example, what is the percentage by volume of fast food restaurant litter within a two block radius of this community's junior high school? List the exact information to be collected by your survey in the space provided. Try to write these in question form. (III-5)

1. ____

____?

2. ____

____?

3. ____

____?

4. ____

____?

You are now ready to help your instructor and your classmates choose a problem for the class to investigate by SHARING YOUR IDEAS. Your instructor may ask for suggestions which can be listed on the chalkboard and discussed. Listen carefully to the possibilities and try to evaluate each. Which seem to be the best possibilities for investigation over a short period of time?

After the local environmental issue to be investigated has been chosen, the process of writing the instrument and planning for data collection can begin. Our goal in this task must be to collect good and useful data - data that are worthy of our time and effort. To be really useful, all surveys, questionnaires, and opinionnaires must deal with several "what" and "where" conditions. For example, what specific information is to be collected? From what geographic area is it to be collected? Also, questionnaires and opinionnaires must deal with "who" factors. From which population will the data be collected? Thought and careful planning on these factors will provide more useful data!

The sequence of questions that follow will assist you and your classmates in dealing with the "what", "where", and/or "who" questions as your survey is being planned. You should respond to those your instructor assigns and then share your work with the class in order to make the best possible plan. Your teacher will probably list suggestions for these questions on the chalkboard and assist in selecting the best possible choices. (III-6)

Making a Survey, Questionnaire, or Opinionnaire: A Planning Sequence

1. What environmental problem (issue) or condition has the class chosen to investigate? ______________________________

____

2. What are the research questions to be answered using the data collected?

____

____

____

____

3. Exactly what information (data) will be collected by this instrument?

4. Is this to be a survey _____ a questionnaire _____, or an opinionnaire _____?

5. If this is to be a questionnaire or opinionnaire, what is the exact population from which the data are to be collected? _____

6. If this is to be an opinionnaire, what are the exact beliefs and/or opinions being investigated? _____

7. What are the exact data collection procedures necessary to collect data with this survey? That is, who will collect the data? How will it be recorded? During what time periods will it be collected? _____

8. What are enough data to insure that the data are representative?

9. How can all the collected data be organized and recorded in a Data Summary Sheet? (Sample Data Summary Sheets were presented earlier in this module.)

Your classmates' BEST responses to the questions above are the guidelines for your future survey and how it will be used. Remember that how the data are interpreted and the findings communicated are subjects for Module IV.

The next step is to prepare your survey using the guidelines written in the previous activity. Again, the examples presented earlier in this module could serve as models. Your teacher may want to edit, type and prepare copies of the final survey or help you do this.

Finally, important details of actually collecting the data must be considered. Which students collect the data? Who collects completed forms? How many student teams are needed? What is the best timetable? These are conditions specific to your class and school and to the nature of the survey. Thus, they must be solved collectively by you with the approval of your instructor.

After your survey has been completed, data summaries must be prepared. These data summaries will be used in Module IV as your findings are interpreted.

Now, let's take a quick look into the future. Module V of this book asks the student to investigate an environmental issue . . . ON HIS or HER OWN! The skills of collecting information learned in this section should be very useful in that task.

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

MODULE III

USING SURVEYS, QUESTIONNAIRES, AND OPINIONNAIRES IN ENVIRONMENTAL INVESTIGATIONS

Objectives for Module III

Overview:

In Module III, students are introduced to the basic research strategies reflected in the title of the module. They identify several environmental topics that lend themselves to gathering data via surveys; via questionnaires; and via opinionnaires. They are presented with models for each of the three techniques and analyze their characteristics. Next, students identify, from a list of ten research questions, those problems which are basically surveys, questionnaires or opinionnaires. Finally, working closely with the instructor, teams of students choose to do surveys, collect data with a questionnaire, or gather data with an opinionnaire and record the data collected.

Specific Objectives: As a function of Module III, students will be expected to be able to . . .

1. . . . name several environmental issues which lend themselves to gathering information using surveys.

2. . . . name several environmental issues which lend themselves to gathering information using questionnaires.

3. . . . name several environmental issues which lend themselves to gathering information using opinionnaires.

4. . . . prepare a list of rules that should be respected when developing surveys, questionnaires, or opinionnaires.

5. . . . identify, from a list of 10 research questions, those items which are basically surveys, those which are questionnaires, and those which are opinionnaires.

6. . . . explain why studies done using questionnaires or opinionnaires are really special kinds of surveys.

7. . . . identify an issue of local concern and make a list of the information that needs to be collected during an investigation of that issue.

8. . . . plan for and conduct a research study which focuses on the use of a survey, questionnaire, or opinionnaire. In addition, successfully communicate the data collected during that research.

SUGGESTIONS FOR TEACHING MODULE III

Module III introduces the students to a variety of strategies they will find appropriate for data collection on a first-hand basis (primary sources). The key elements of this module are: (1) designing surveys, questionnaires, and opinionnaires that obtain data pertinent to a specific question and/or problem recognized by the investigator; (2) organizing, compiling, and recording data consistent with the survey, questionnaire, or opinionnaire used.

The first portion of the module is limited to the application of rules governing good survey techniques. Exercise III-1 (page 87-SM) focuses on getting the student to recognize the parameters of surveys and the kinds of questions and/or problems for which surveys can provide useful data. If the students do, in fact, incorporate most of the major conditions critical to surveys in his responses on Exercise III-1, the instructor can infer that appropriate conceptualization has taken place. However, if some students cannot accomplish this, the instructor should provide them with additional time, help, and practice in writing correct responses. Students are next presented with a model survey containing the survey (research) questions, procedures, data grid and a summary analysis sheet. The students should examine these carefully and identify the survey characteristics of the module.

The second portion of Module III focuses on techniques of designing, and implementing questionnaires and opinionnaires that will provide good, useful data. Exercise III-2 (page 91-SM) focuses on getting the student to recognize the parameters of questionnaires and the kinds of questions and/or problems for which questionnaires can provide useful data. The discussion following Exercise III-2 points out a distinct difference in the purpose of opinionnaires and questionnaires. It seems appropriate to point out that questionnaires are designed to collect hard, cold facts or data, whereas, opinionnaires are designed to determine what are people's thoughts about a specific topic at a specific time or what their feelings are on a specific question and/or subject. An excellent teacher reference on questionnaires is: Questionnaires: Design and Use by Douglas R. Berdie and John F. Anderson, available from The Scarecrow Press, Inc., Metuchun, New Jersey 08840.

As with surveys, the students are presented with a model of a questionnaire and its data summary sheet. Students should examine the model and discuss why it represents a good questionnaire.

In Module III, the students are presented with the characteristics of surveys, questionnaires and opinionnaires, but few formal rules for their development. The instructor may wish to have the class establish the rules to follow when conducting each of these techniques. A class discussion or small group activity can be used to accomplish the generation of the three sets of rules. Since the rules will control the quality of the survey products the students generate, the experience should prove to be very valuable from a learning standpoint and worthy of the time it takes to accomplish it. The rules for surveys, questionnaires, and opinionnaires are as follows:

Rules Governing Surveys, Questionnaires, and Opinionnaires

S = Survey   Q = Questionnaire   O = Opinionnaire   X = Applies to

S	Q	O	Rules
X	X	X	1. Carefully decide the exact information (data) to be collected.
X	X	X	2. Specify the exact geographic area in which the data are to be collected.
	X	X	3. Specify the exact population from which the data are to be collected.
		X	4. Specify the exact opinions and/or beliefs about which the data are to be collected.
X	X	X	5. Collect enough data to make sure that the data are truly representative of the problem in question.
X	X	X	6. Record all data collected carefully and completely.
X	X	X	7. Work out a system that will accurately communicate the data to others, e.g. charts, graphs, tables, written discussion.
X	X	X	8. Make sure that all conclusions, inferences and recommendations are substantiated by the information collected. (see Module IV)

EXERCISE III-3 (page 95-SM) has the student write specific questions and/or problems for which an opinionnaire can be used to collect data. The use of a question format for the responses is recommended. This task gives the student practice in setting parameters for opinionnaires that will insure the collection of meaningful data. It is followed by a model opinionnaire concerning littering. This model should require little or no modification.

EXERCISE III-4 (page 99-SM) is a self-test designed to help the student determine whether or not he fully understands the parameters of and distinct differences between surveys, questionnaires, and opinionnaires. If a student responds correctly to all ten items on the self-test, the instructor can infer that the student has conceptualized the information presented in the previous exercises (.... or that the student is a good guesser!!). Students should be encouraged to correct any errors by applying the rules governing surveys, questionnaires, and opinionnaires to the statement or problem in question.

EXERCISE III-5 (page 101-SM) gives the student an opportunity to identify, in question form, the specific information which needs to be collected on a local issue of his/her choosing. The activity is of an application nature. The instructor should check the correspondence of the issue to the information the student seeks to collect. Has the student accurately determined whether the issue is oriented to a survey, questionnaire or opinionnaire technique? If so, has the student correctly applied Rules 1-4 identified on the previous page in the teacher's edition?

EXERCISE III-6 (page 102-SM) exists as the culminating activity of Module III. In this exercise the students are to do an actual survey, questionnaire or opinionnaire. The PLANNING SEQUENCE should be carefully followed once a decision on the problem or issue to be investigated has been made. The instructor may decide to use one of the models presented in the module or to allow the students to select an entirely different problem/issue. In either case, it is recommended that the planning sequence be used as it presents an analytic approach to one aspect of issue investigation and serves to bring skills developed in Modules I, II, and III together in an applied setting. It will also assist the students when they undertake autonomous research in Module V.

When setting up Exercise III-6 the instructor may want to consider the following suggestions:

(1) Arbitrarily divide the class into research teams. It is preferable not to assign more than 4 students to a team.

(2) The instructor may choose to allow each team to decide whether they are going to do a survey, questionnaire, or opinionnaire. The instructor may, however, wish to arbitrarily assign a survey, questionnaire, or opinionnaire to each team. It is imperative at this point to make sure that a survey, a questionnaire, and an opinionnaire are being done within each class.

(3) Carry out the surveys, questionnaires, and opinionnaires.

(4) Using data sheets, ask each team to share its findings with the rest of the class. This may be done in several ways: (1) short, informal oral reporting; (2) duplication of data sheets; (3) written discussion of the data. Class discussion and analysis should ensue.

The instructor should utilize the team reports to reinforce the rules governing good surveys, questionnaires, and opinionnaires. Students should be encouraged to evaluate the reports in this dimension. Further, the instructor should stress the point that the skills learned in this module can be transferred to new situations demanding similar research skills.

MODULE IV

INTERPRETING DATA IN ENVIRONMENTAL INVESTIGATIONS

Introduction

Science is sometimes called sensory reality. This means that only those things that can be observed are considered real to the scientist. The "sensory reality" definition of science does NOT cover ALL of what science is all about. But, it does offer us some clues as to what we are able to do with information collected during research.

Information collected by the scientist must be interpreted. It won't just lie there interpreting itself. Interpretation is a human task and is no better than the skills of the person doing the interpreting. Therefore, if a person reads too much into the data he/she runs a serious risk of making incorrect statements as a result. It can be very embarrassing to have someone prove you wrong later on. More importantly, reading too much into your data can also cause you to make some very poor decisions regarding your research question(s).

This module is designed to help you become familiar with a few of the basic types of data interpretation. It will not cover all aspects of interpretation nor will it cover all possible situations in which you might find yourself. However, if you learn to use the rules presented, you should be able to transfer these skills to new situations without too much trouble.

Objectives for Module IV

Upon completion of Module IV you will be expected to be able to . . .

1. . . . define conclusion, inference, and recommendation.

2. . . . distinguish between a conclusion and an inference (from a scientific perspective).

3. . . . evaluate conclusions based on observations.

4. . . . write conclusions and inferences for everyday-type observations.

5. . . . defend the idea that a person can make more than one inference for a particular observation (or set of data).

6. . . . write conclusions, inferences, and recommendations for imaginary scientific data.

7. . . . write conclusions, inferences, and recommendations for real scientific data.

8. . . . demonstrate the ability to graph scientific data.

9. . . . communicate the advantages that graphic data can have over descriptive data.

10. . . . revise a recommendation (if necessary) based on new information.

Conclusions

Everyone knows what a conclusion is. It's the end or the finish to a speech, a story, or a meal. A good meal concludes with dessert, right? But, what about conclusions in science? What are they? How do we use them? How can we keep from making mistakes with them?

A conclusion in science is not too difficult to understand. Even so, it is easy to misuse or abuse conclusions. Lots of people do exactly that! A conclusion in science is an expression or a statement of the end result. It is the final result - the outcome.

Most people mess up conclusions when they use them to interpret the results of a study. That is, problems arise when they try to explain why something happened as it did. This is NOT a conclusion. It is something else which we will go into later.

Let's see if we can help you get the idea more fully. We'll call this Exercise IV-1 and begin it with an example:

> Some years ago, a scientist observed that sparrow hawks prey on and eat certain song birds such as the yellow warbler. She observed this phenomenon on several field trips at a variety of locations. (Of course, sparrow hawks prey on and eat large quantities of mice and large insects also.) The scientist wrote up her findings and made the following two conclusions:
>
> Conclusion 1: Sparrow hawks and warblers have a predator-prey relationship in areas where both exist.
>
> Conclusion 2: It appears as though the sparrow hawk may be a harmful factor in the reproduction capacity of warbler populations.

Now, how do these conclusions strike you? Do they seem logical and fitting for the scientist's observations? Put your thoughts on paper. If the conclusions seems alright, check "yes". If not, check "no".

Conclusion 1: Yes _____ No _____

Conclusion 2: Yes _____ No _____

Conclusion 1 is excellent. It follows exactly the observations made by the scientist. Conclusion 2 probably resulted because the scientist felt that warbler populations were harmed by the sparrow hawks. It is a terrible conclusion! Why? Because it is not a statement of the results of the scientist's observations. It is, instead, her personal interpretation of the results and goes beyond the observed data. She might infer the statement about reproduction. She might even develop a research question to investigate whether this relationship exists, but IT IS NOT A CONCLUSION!

We are not finished with the business about conclusions but, for a little while, we are moving to another term. That one is inferences.

Inferences

In the dictionary you will often find that conclusions and inferences are used similarly - that they are synonyms. Not true in science! Even though some people misuse these terms in science we are going to ask YOU to be correct in your use of them.

An inference is an implication - an assumption or a judgement made from data (or from conclusions).

Conclusion No. 2 in Exercise IV-1 was an inference, although not a very good one. But, still, it was an inference because it was a judgement made by the scientist on the data observed.

Some experts say that an inference is an explanation of an observation. That's a pretty good definition because it helps us remember that an observation is what we see and an inference is the explanation of the observation. A number of years ago, a famous scientist by the name of Alexander Fleming observed that certain bacteria grew poorly or not at all when in the presence of certain molds. He inferred that there was something about the mold that kept the bacteria from growing and reproducing. This inference resulted in the development of penicillin. Quite an important inference, wouldn't you say? But, in this example it is rather easy to see the difference between an observation and an inference.

Conclusions and Inferences Made Easy

Suppose you and a friend walked to town one lovely summer evening and decided to go to a movie after getting there. After two hours of entertainment, you leave the theater and walk out onto a wet sidewalk. Further, the streets are wet and puddles of water stand here and there. From this situation you can . . . (IV-2)

Conclude? ____

____.

Infer? ____

____.

The next morning, you look out the window and see a moving van backed into your neighbor's yard. What can you . . .

Conclude? ____

____.

Infer? ____

____.

A little while later, you see what appears to be the driver of the moving van pouring something into the truck's fuel tank from a five gallon can. What can you . . .

Conclude? ____

____.

Infer? ____

____.

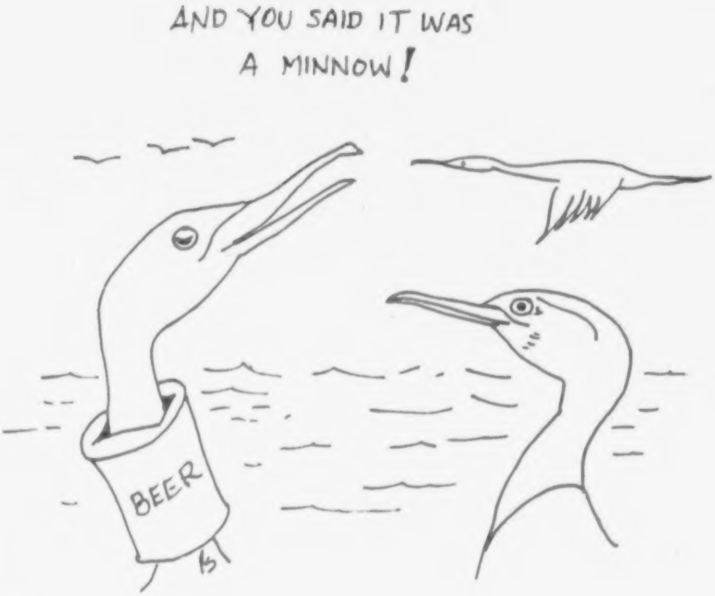
Let's see how well you have done. When you walked out of the movie theater there wasn't much you could conclude except that the streets and sidewalks were wet for some reason. But, you could infer that it had rained while you were watching the movie.

With the van backed into the neighbor's yard you could probably conclude that a moving van had backed into the yard sometime during the night or early morning. You possibly infer that the neighbors are moving.

The person at the fuel tank of the moving van might or might not be the driver, but you can conclude that someone is pouring something into the fuel tank of the truck. You might infer that the substance is diesel fuel.

What one thing is clear about these inferences? Yes, they are explanations of observations you have made. Something else should be clear (but it might not be). That is simply that you proved NONE of your inferences. You say this isn't important? Wait just a minute! A water truck sprayed the streets in the downtown area the night you went to the movie. The van's driver backed into the wrong yard. The driver was pouring gasoline into the fuel tank - the truck doesn't run on diesel fuel!

You think you were tricked? Perhaps! But we are trying to make a point here - that inferences are NOT proof until they have somehow been tested. How do you test an inference? In the case of our examples it would have been easy. You ask a police officer if it rained while you were in the movie. You ask the neighbors if they are moving. You ask the driver of the van what is being poured into the truck's fuel tank! In each case, whether the person talked to knows it or not, you are testing an inference. When an inference becomes something testable in science we call it a hypothesis. But, for now, we will leave hypothesizing out of the picture.


AND YOU SAID IT WAS A MINNOW!
BEER

Would You Like to Make a Recommendation?

Don't worry, we won't forget conclusions and inferences. We will return to these after awhile. But, we are going to take just a little of your time and deal with recommendations. What is a recommendation? How do we go about making good recommendations?

A recommendation is a piece of advice given to a person or a group concerning some particular action or problem. It is normally something you are in favor of - something you would advise being done. In science, however, a recommendation must be consistent with the findings of the study. In other words, you must never recommend something that cannot be defended in terms of the research. Even so, recommendations often reflect a person's values (even though they can be defended by the data).

Let's try an example. Suppose a student did a survey of litter in a certain neighborhood and observed large numbers of beer cans lying around. He infers that residents of the neighborhood or passers-by (or both) throw empty beer cans around the area. His recommendation is that the City Council pass a city ordinance forbidding the sale of beer in cans. Naturally, this is a ridiculous recommendation to make (based on this study). If the student wants to get the city to forbid the sale of beverages in metal cans, he had best find another reason for making that particular recommendation.

However, what kinds of recommendations might the student make during his research report? Write at least two logical recommendations below: (IV-3)

Recommendation 1: ______________________________

____

____.

Recommendation 2: ______________________________

____

____.

Even though you don't have a lot of information about this litter survey, there are several recommendations that seem logical. The student might recommend stepping up anti-littering law enforcement in the area. Further, he might recommend an educational program in the city to demonstrate the ill effects of littering in the area. A recommendation that would produce at least temporary relief could result in a civic or school group cleaning up the neighborhood as a public service project.

It All Depends On How We Look At Things

We've been talking about conclusions, inferences, and recommendations. Very soon, you will have a chance to apply what you have learned. But before you do, you need to look at one more part of data interpretation - how the data are communicated.

Data interpretation depends, many times, on how the data are reported. Let's look at some real information that is presented two different ways to see how this is true. Our topic will be the food resources for deer in eastern hardwood forests. The first method we will use to communicate the information to you is called descriptive. The second method is called graphic. See if you don't think that there is a good deal of difference between these two methods.

A Descriptive Account of Browse Production

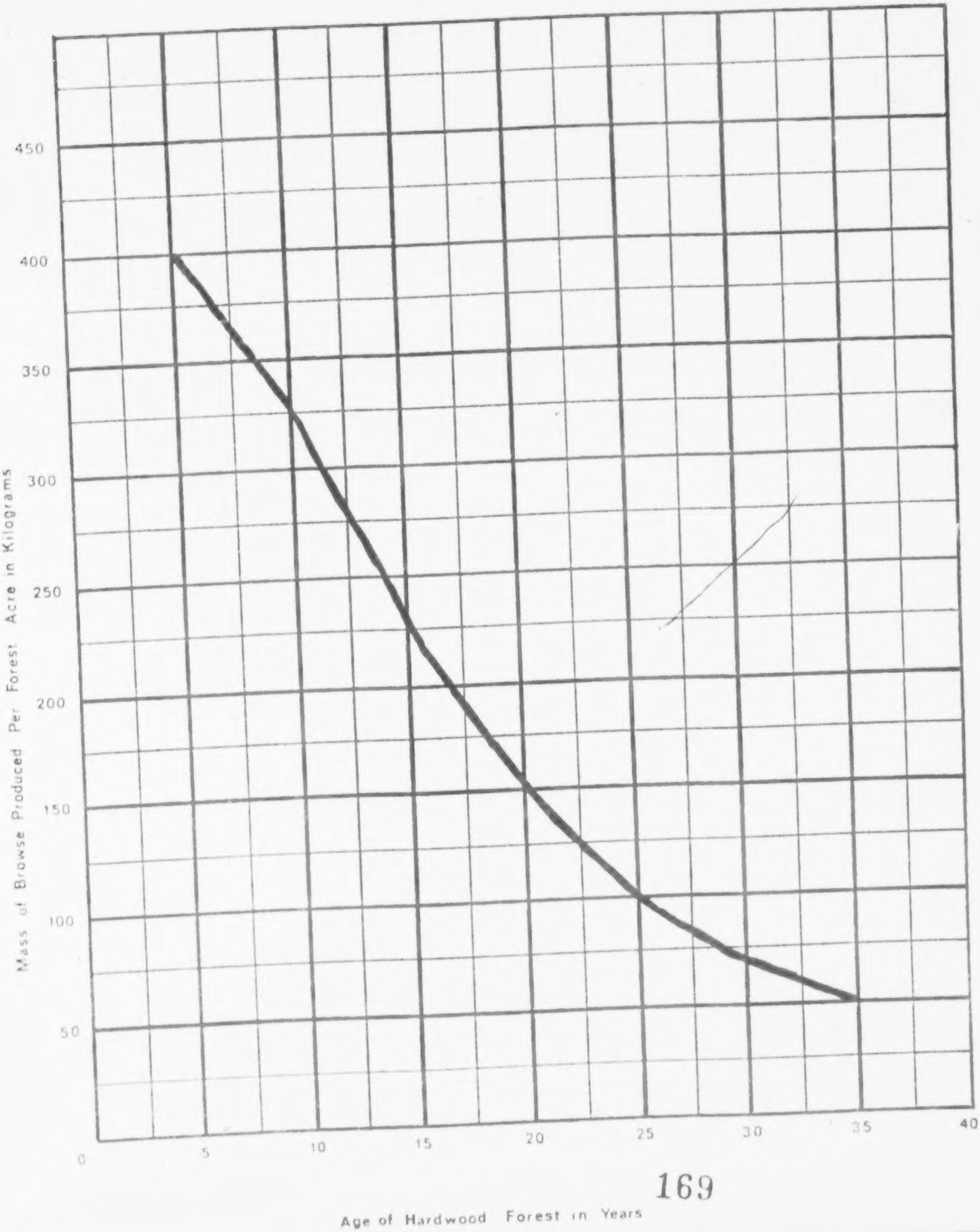
The food available to deer in a hardwood forest is called browse. Browse consists of the buds, stems, leaves, and fruit of forest trees, shrubs, and herbs. Deer forage on these plant parts as they graze through a forest at night or early in the morning. If this kind of browse isn't available to deer, they will often turn to the grain or fruit crops of farmers. For example, deer love apples and will even swallow them whole if they are small enough.

Wildlife experts know that the amount of browse available to deer is controlled by the height to which a deer can reach when feeding. Therefore, a very young forest will often have more available browse than an older, more mature forest. A five year old forest with small trees will produce about 400 Kg of browse per acre per year. At fifteen years of age, the production of browse is reduced to about 225 Kg per acre per year. At twenty-five years of age, browse is reduced to slightly over 100 Kg and, at thirty-five years of age, browse production falls to only about 50 Kg per acre per year. The age of a forest, then, can have a lot to do with the size and general health of a deer population.

A Graphic Account of Browse Production:

Please refer to the graph on the next page.

Browse Production in a Hardwood Forest



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(IV-4) You've just looked at two different methods for presenting data. Both of these techniques of reporting data communicate some of the same things. What conclusion can be drawn from both sets of data? State it here: ____________________

____

____________________.

Record an inference that can logically be drawn from both sets of data:

____

____

____________________.

Now, how do the two sets of data differ? Of course, there is a definition of browse in the descriptive data which does not appear in the graphic data. But, other than this and the fact that one is descriptive and the other graphic, how do they differ? ____________________

____

____________________.

All things considered, the graphic form of reporting is probably better than the descriptive. Why? The data show a relationship between the age of the forest and the amount of browse produced. The relationship is simply this: Younger hardwood forests produce more browse than older forests. But, reading that relationship is not nearly as effective as seeing the relationship described on a graph.

Further, the graph shows that the rate of decline in browse production is slowed somewhat after the forest reaches 25 years of age. This would permit the investigator to predict that the amount of browse in a 45 year old forest would not be a great deal less than in a 35 year old forest. Is there any way this could be predicted from the descriptive data? Probably not!

So, how you communicate data and how you interpret it depends upon the kind of information you have and what you want to do with it. Always communicate your data in the most logical way. And, remember that how well you can interpret your data may depend on how you choose to communicate the data.

Producing a Line Graph (IV-5)

Do you think you can report data in graphic form? Graphing is a skill just like any other process. We are going to ask you to graph some historical data collected over the years about deer populations on the Kaibab Plateau in Arizona. You may be getting a bit tired of studying deer but these figures might surprise you - particularly after you see them on a line graph. Here are the data:

Deer Populations on the Kaibab Plateau from 1907-1938

Year	Approx. Population of Deer
1907	6,000
1910	10,000
1915	25,000
1920	56,000
1923	100,000
1925	85,000
1930	30,000
1935	14,000
1938	9,000

Please graph these data using the worksheet provided on the next page. The population variable should go on the vertical axis of the graph. The year variable should go on the horizontal axis. Label both axes!

Your instructor will want to check your work on the graph. Also, he/she may ask you to do some additional tasks connected with reporting data. If so, hang in there and get the job done well. You are almost ready to be an independent investigator of environmental problems.

Applying Your Data Interpretation Skills

(IV-6)

Using the Kaibab Plateau deer population data given by the graph, write out the best possible conclusion that can be drawn from the data!

Now, we will tell you that, between 1907 and 1923, 300 coyotes and 600 mountain lions were killed on the Kaibab Plateau. For the years between 1907 and 1923, write the best possible inference you can from all the data at your disposal.

Lastly, we tell you that, during the years of increasing and decreasing deer populations, the range of the deer was so badly overgrazed that thousands upon thousands of deer died from starvation. What logical recommendation(s) would you make based on all available data?

Another Try at Data Interpretation

You are probably getting better and better at data interpretation. That is good! These skills are very important, especially if you intend to make decisions based on your research findings. Let's look at another set of data, one having to do with the coyote.

Western ranchers have been at war with the coyote for some time. Sheep ranchers, in particular, have said that coyotes cause economic losses by killing many of their animals. For years, the government has helped farmers and ranchers control coyote populations. Traps, poisons and even hunting by airplane have been used to reduce the number of coyotes.

Let's suppose you wanted to make a decision about whether the government-sponsored coyote control programs should be continued. Your research question might look like this: RESEARCH QUESTION: To what extent should a government-sponsored coyote control program be continued in the western states?

Below you will find some data collected in Kansas by scientists who analyzed the stomach contents of 1600 coyotes killed by hunters during one year. These data will be helpful to you in answering your research question. As you study the data table and the additional information it will be important to keep the research question in mind.

An Analysis of the Stomach Contents of 1600 Coyotes

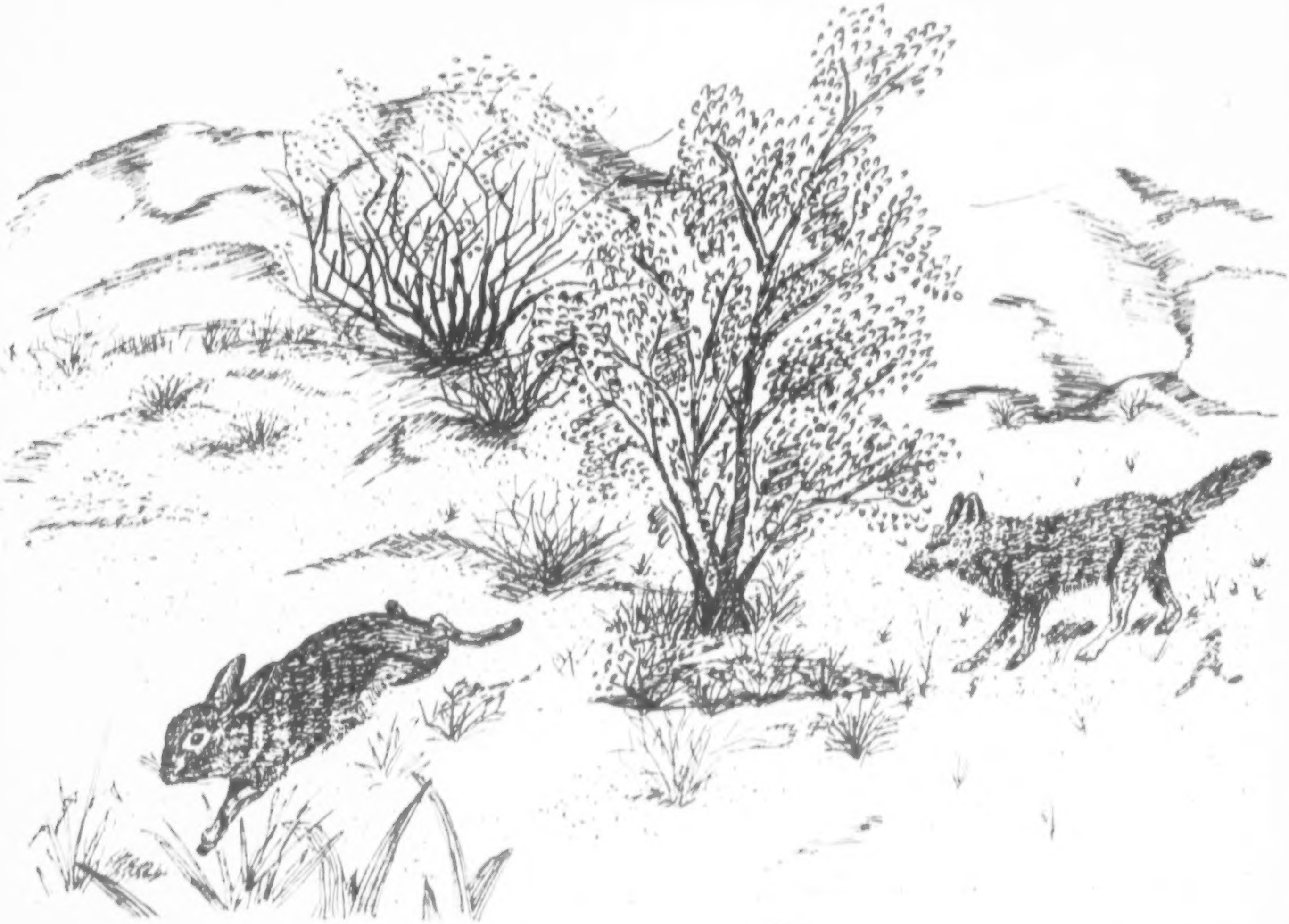
Percentage of Diet

	Rabbit	Carrion	Chicken	Rodent	Other
Spring	45.7	26.0	11.5	11.8	5.0
Summer	47.7	19.3	15.3	10.0	7.7
Fall	47.3	23.0	10.3	10.7	8.7
Winter	52.7	27.7	8.3	8.0	3.3

(Adapted from You and the Environment-An Investigative Approach, 1976.)

As the scientists examined the contents of the coyote stomachs, they placed the food types into several categories. "Rabbit", of course, included the percentage of rabbits which were found. "Chicken" included any poultry or wild birds. "Other" included fruits, grains, insects, and snakes. "Carrion" included decaying flesh, whether it came from wild animals or livestock. Coyotes often find carrion on the range. The scientists noted that most of the livestock flesh found in coyote stomachs was decaying before the coyotes ate it. Fresh livestock appeared to make up a very small portion of the coyote's diet.

There are some coyotes whose main diet is fresh livestock. They are called "killer" coyotes and are small in number. Often these coyotes are crippled and have difficulty in catching rabbits and rodents. They usually attack sheep, which are much easier to catch.



Now, let's repeat the research question: To what extent should a government-sponsored coyote control program be continued in the western states? In order to answer this question, you will need to make a conclusion regarding the coyote's diet. Please write a conclusion which summarizes those food types which coyotes eat frequently, those that are eaten some of the time, and those that are rarely eaten. What is your conclusion drawn from the data? (IV-7) Conclusion: ______________________________

____

____

____

______________________________.

Next, write an inference based on your conclusion. In fact, several inferences are possible, depending on what outcomes were cited in the conclusion. To write the most appropriate inference, keep in mind the focus of the research question. Remember, an inference is an explanation or judgement based on the data. Inference: ______________________________

____

____

______________________________.

Finally, write a recommendation which is consistent with the findings. That is, what advice would you offer concerning the continuation of government-sponsored coyote control programs? Recommendation: ______________

____

____

____

______________________________.

Perhaps additional information could assist in writing a more specific recommendation. One method of coyote control is the use of a long-lived poison, "1080". The poison 1080 is usually placed on carrion. Unfortunately, this poison becomes available to many other wild and domestic animals besides coyotes. Ferrets, eagles, dogs and other animals are killed by 1080. Many sheep ranchers support the use of 1080 in government-sponsored coyote population control programs. Many conservationists are violently opposed to its use. With this information in mind, write another recommendation about the use of 1080 which is consistent with the data. Recommendation: (IV-8)

A few other thoughts about the coyote data are necessary. Our original research question asked about the extent to which government-sponsored coyote control programs should be continued. Do the data, as they are presented in this module, directly answer that question? Please explain your answer. Yes ____; No ____. (IV-9) Please explain:

It is also important to remember that the data presented deal only with Kansas coyotes. To what extent do you think your conclusions, inferences, and recommendations are valid for other western states? Please explain your answer. (IV-10)

Data Interpretation With Surveys

(IV-11)

We've asked you to practice your interpretation skills using data collected by scientists. Now, let's look at data similar to those which YOU might collect. Let's pretend that the opinionnaire "Opinions About Littering" (in Module III) was completed by your class. Further, let's pretend that two samples - adults and junior high students - were obtained. Below, you will see Question 1 from that survey and some imaginary data which might have been collected.

Question 1: Do you consider littering of public and/or private property to be a problem in this community?

Yes ____; No ____; Undecided ____.

Data Summary: Question 1

Sample: junior high students (47)

	males	females	total
Yes	5	4	9
No	17	20	37
Undecided	0	1	1

Sample: adults (52)

	males	females	total
Yes	15	19	34
No	10	8	18
Undecided	0	0	0

Carefully study the data summaries of both samples. Look at how the junior high sample answered the question. Now note how the adults answered the same question. Did both groups answer the question in the same way? Now, write a conclusion for Question 1. Remember that a conclusion is a summary of what happened. Conclusion: ____________________

Your conclusion should have noted that more adults than junior high students believed that littering was a community problem. If your conclusion did not focus on this, carefully re-examine the data.

DEPOSIT
LITTERERS

Your next task is to infer why this difference might have been observed. In other words, why did adults answer the way they did, compared to the way junior high school students did? (Why might there be more than one inference here?) Inference: ____________________

____

____

____________________.

The final task is to write a recommendation. Think about the difference which you observed between adults' littering beliefs and those of junior high students. Based on the inference you wrote, what recommendation might you make? (If you feel that it is impossible to make a recommendation based on your inference, please comment on this in the space provided and explain why.) Recommendation: ____________________

____

____

____

____________________.

With this practice, the process of data interpretation should be clearer. However, a bit more practice will probably prove useful. Therefore, let's examine more imaginary data from our opinionnaire. It will be found at the top of the next page.

Question 5: What age person do you believe is most responsible for the littering?

A. Students below junior high age.
B. Students of junior-senior high age.
C. College age citizens.
D. Citizens over the age of 21.

Data Summary: Question 5

Sample: junior high students (47)

	males	females	total
Response A:	5	5	10
B:	7	6	13
C:	6	6	12
D:	6	6	12

Sample: adults (52)

	males	females	total
Response A:	0	1	1
B:	18	20	38
C:	6	5	11
D:	1	1	2

Use the data summaries above to make conclusions, inferences, and recommendations for Question 5. Remember that conclusions are summaries of what happened. Inferences are explanations of why it happened. And, recommendations must also be consistent with both the conclusions and the inferences.

Conclusion, Question 5: ______________________________

Inference, Question 5: ______________________________

Recommendation, Question 5: ______________________________

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

MODULE IV

INTERPRETING DATA IN ENVIRONMENTAL INVESTIGATIONS

Objectives for Module IV

Overview:

In Module IV students are introduced to techniques of reporting and interpreting data. Students receive practice in identifying and writing conclusions, inferences and recommendations that are consistent with data collected. Similarly, students are asked to apply the critical rules of formulating conclusions, inferences, and recommendations by evaluating and rewriting the conclusions, inferences, and recommendations made by the investigators on a variety of research questions involving data collected from secondary sources and surveys.

Students are introduced to descriptive and graphic techniques that may be used to report data. They are asked to write one conclusion and one inference that is consistent with one set of data presented descriptively and graphically. The students transfer one set of data to a line graph and write one conclusion, one inference, and one recommendation that are consistent with that data. Finally, students apply the skills of concluding, inferring and recommending to two different sets of data, one regarding coyote diet, and one regarding opinions on littering.

Specific Objectives: As a function of Module IV, students will be expected to be able to . . .

1. . . . define conclusion, inference, and recommendation.

2. . . . distinguish between a conclusion and an inference (from a scientific perspective).

3. . . . evaluate conclusions based on observations.

4. . . . write conclusions and inferences for everyday-type observations.

5. . . . defend the idea that a person can make more than one inference for a particular observation (or set of data).

6. . . . write conclusions, inferences, and recommendations for imaginary scientific data.

7. . . . write conclusions, inferences, and recommendations for real scientific data.

8. . . . demonstrate the ability to graph scientific data.

9. . . . communicate the advantages that graphic data can have over descriptive data.

10. . . . revise a recommendation (if necessary) based on new information.

SUGGESTIONS FOR TEACHING MODULE IV

In Module IV the students are acquainted with techniques of reporting and interpreting data. In order for the data collected by an investigator to be meaningful, it must be communicated to other investigators and interested individuals. The investigator should report the data as simply as possible in a concise, logical, and orderly sequence. Furthermore, it is the investigator's responsibility to provide, on the basis of the data, an interpretation of the data collected, e.g., drawing conclusions, making inferences and recommendations.

The writers have found that students understand the importance of clear, concise communication better if one basic rule is followed: All scientific writing should be completed in such a manner that someone completely unfamiliar with it can understand it.

Essential components of this module to be mastered are: (1) rules governing the reporting of data; (2) rules governing the formulation of conclusions, inferences, and recommendations; and (3) the application of these rules in a variety of environmental situations.

EXERCISES IV-1 and IV-2, (page 107 and 108-SM), focus on getting the student to recognize important guidelines for drawing conclusions and making inferences. It is imperative at this point for students to conceptualize what constitutes a good conclusion and a good inference. In addition to the exercises in the student edition, it is suggested that the teacher present several scenes to the students, either orally or in writing, and ask the students to write one conclusion and one inference based upon the information presented. Two such scenes are provided in the paragraphs following. The students should be asked to defend their responses in accordance with the parameters established for writing good conclusions and inferences. Student defenses may be oral or in writing depending upon which teaching strategy is preferred.

During this exercise the teacher and students must keep firmly in mind that: (1) conclusions follow exactly the observations made; (2) a conclusion is the communication of an observable event, happening, and/or situation; (3) a conclusion in no way attempts to explain why something happened as it did; (4) a conclusion is simply an expression or statement of the end result; (5) an inference is the explanation of an observation; (6) an inference is an implication - an assumption or judgement made from the data (or from the conclusions).

Scene #I

> A botanist visits a woods every ten years to study a population of wild, rare orchids. Each year he observes that the population gets smaller. The conditions in which the orchids are growing seem to change very little. Although he sees no people there on his trips, he does note increasing evidence of camping in the woods.

Possible Responses:

Conclusion: The orchid population decreases steadily.

Inference: Campers are probably digging up orchids and taking them home.

Scene #II

Waggonerville, a small town in Arizona with a population of about 5000 people, is located in a large canyon. Five years ago a copper refinery was built and began operating in Waggonerville. In the process of smelting the copper ore the refinery pours large quantitites of smoke into the air. Since the town and refinery are located in a canyon the smoke is not readily dispersed by the wind.

While checking hospital records, a local doctor noticed that respiratory ailments had increased 250% during the five year period the refinery had been in operation.

Possible Responses:

Conclusion: Respiratory ailments have increased 250% since the refinery began operation.

Inference: There is a cause and effect relationship between the refinery operation and respiratory ailments.

EXERCISE IV-3, (page 111-SM), focuses on the parameters necessary for making recommendations. A recommendation is a piece of advice given to a person or persons concerning some particular action or problem.

It is important in Exercise IV-3 that students realize that any recommendations they make must be completely consistent with the data collected. The teacher should not hesitate to ask students to defend recommendations they make either on the basis of data given in the exercises or data they collect in their own study.

IN EXERCISE IV-4, (page 114-SM), the student is asked to write one conclusion and one inference that is consistent with the same data presented two different ways. The focus of the exercise is to point out how the technique an investigator chooses to present his data affects his communication and interpretation of that data. Pros and cons of presenting data graphically and/or descriptively are presented in the paragraphs following the exercise. (See page 114-115-SM).

Possible Responses:

Conclusions that may be drawn from both sets of data are:

1. Browse production in a 5-year old hardwood forest may be 400 Kg per acre per year, whereas in a 35-year old forest browse production may be only 50 Kg per acre per year.
2. Younger hardwood forests produce more browse than older forests.

Inferences that may be drawn from both sets of data are:

1. A young hardwood forest will support a larger deer population than an old hardwood forest covering the same amount of area.
2. As trees grow taller, browse production in a hardwood forest decreases.

EXERCISES IV-5 and 6 (pages 115 - 117-SM), ask the student to plot graphically quantitative data concerning the Kaibab deer population and draw a conclusion on the basis of that data. Subsequently, new information is provided for the student whereupon he is asked to make an appropriate inference and write one appropriate recommendation.

A valid conclusion that might be formulated from the data would be:

> The deer population of the Kaibab Plateau increased from 6,000 in 1907 to a maximum of 100,000 in 1923, then decreased steadily to 9000 in 1938.

An appropriate inference might be:

> The deer population initially increases because the natural enemies of the deer such as the coyote and mountain lion are killed off.

Possible recommendations would be:

1. Laws prohibiting the killing of natural enemies of the deer, such as coyotes and mountain lions, should be enacted and enforced.
2. Hunting of both does and bucks should be allowed in those areas where natural predators have been removed or severely reduced in population.

EXERCISE IV-7 (page 120-SM) provides the students with another opportunity to apply their skills in interpreting data, formulating conclusions, inferences and recommendations. Students are given tabular data regarding the stomach contents of 1600 coyotes and a prose description of the food categories used in the data table. The concept of "killer" coyotes is also introduced. It should be noted here, that the writers were unable to find any further research data on "killer" coyotes in terms of their behaviors and their relative number in proportion to the total coyote population. This points out the important idea that further scientific investigation is needed in the coyote situation (as well as in many other environmental problem/issues areas). The coyote issue may also be viewed as a possible topic for autonomous student investigation (Module V).

Possible Responses:

Conclusion: On the basis of per cent of stomach contents, food types eaten most frequently by coyotes in Kansas are rabbits followed by carrion; food types eaten some of the time are poultry, wild birds and rodents; food types that are rarely eaten are fruits, grains, insects, and snakes. Fresh livestock appears to make up only a small portion of Kansas coyotes' diet.

The most appropriate inferences that may be drawn on the basis of the conclusion and research question are:

1. Based on analysis of the stomach contents of 1600 Kansas coyotes, decreases in livestock populations in Kansas cannot be attributed to predation by coyotes.
2. Kansas coyotes feed primarily on wild animals, carrion and vegetation rather than on domestic livestock.

It should be noted that both inferences convey the same intent although stated differently.

Recommendations that are consistent with the findings are:*

1. Government-sponsored coyote control programs in Kansas should be discontinued.
2. Government-sponsored coyote control programs in Kansas should be limited to the careful identification and elimination of "killer" coyotes only.

Recommendation #2 is the better of the two choices.

IN EXERCISE IV-8, (page 121-SM) a sample of an appropriate recommendation regarding 1080 is:

> Use of the poison 1080 should be banned in government-sponsored coyote population control programs in Kansas.*

---

*The instructor should note that all of these recommendations reflect a pro-ecological view. Even though they are consistent with the data, they do indicate a particular value perspective. Other individuals with other value perspectives might write different recommendations which are not inconsistent with the data as presented.

Instructors may wish to allow students to add to this recommendation the reasons as to why they think it is appropriate. Some reasons include the conclusion regarding the normal dietary components of the coyote population (Exercise IV-7) and the prose data regarding the accidental poisoning of animals other than coyotes (page 120-SM).

EXERCISE IV-9 (page 121-SM) requires the students to determine if the data regarding coyote diet, killer coyotes and the effects of 1080 are sufficient to directly answer the research question. The most appropriate response is NO, the data do not directly answer the research question as posed. None of the data are directly related to the "extent to which the government coyote control program should be continued". Although the data presented indirectly build a case for the reduction or possible elimination of the program on the basis of ecological reasons (normal coyote diet) as well as the safety of wild and domestic animals (accidental 1080 poisoning), they are limited to Kansas only. In order to answer the research question directly, data need to be collected regarding some, if not all, of the following variables:

1. actual numbers of livestock killed
2. causes of livestock deaths (e.g., parasites, disease, killer coyotes, poisoning)
3. number of "killer" coyotes in the coyote population

and, these data must be collected for the entire western region rather than only Kansas. This last point is further stressed in the next exercise.

EXERCISE IV-10 (page 121-SM) introduces students to the concept of generalizability of data. The instructor should be sure that students realize that the conclusions, inferences and recommendations they have made in Exercises 7-10 are valid to only Kansas and cannot be generalized to other western states. Students often wish to extend the results of data collection and interpretation far beyond the population or region on which the data were collected. It has been the authors' experience that students also tend to overgeneralize when doing their autonomous research (Module V). Exercise IV-10 is intended to teach the limits of generalizability and, hopefully, reduce the frequency of overgeneralization on the part of the students.

EXERCISE IV-11 (pages 122-126-SM) is a final experience in interpreting data, drawing conclusions, formulating inferences and making recommendations. Students use imaginary opinionnaire data regarding littering to accomplish the task. The instructor should note that the exercise is broken up into two sections--the first, examining only the data from Question 1 and the second, examining data for Question 5. The instructor should note that this instructional sequence has been purposefully organized in this way in order to give the students practice in the above mentioned skills. In actual research practice, the data from responses to all opinionnaire data would usually be interpreted as a whole rather than question by question. The coyote diet data (both tabular and prosaic) in Exercise IV-7 is a good example of interpreting an entire set of data.

After the students have responded to the various tasks in the exercise, the instructor may wish to divide the class into small groups and assign the various tasks to certain groups. Students can then report their conclusions, inferences and recommendations to their classmates and have the entire class critique the responses of the groups.

Sample responses for the tasks in Exercise IV-11 follows:

Question 1.: Do you consider littering of public and/or private property to be a problem in this community?

Conclusion: More adults than junior high students believed that littering was a community problem. The students are presented with the conclusion on page 123-SM.

Inferences:

1. Individuals of differing ages view the problem of littering differently, i.e., have differing beliefs about littering.
2. Adults value a non-littered community environment more than junior high school students.
3. Junior high school students are more tolerant of a littered community than are adults.
4. Junior high school students do not see the relationship between human activity and the littering problem to the extent that adults do.

There are probably many more plausible inferences. The situation allows for more than one inference since two distinct age groups were the sources of the opinions and, therefore, inferences can be made for each group's set of responses.

Recommendation: None, at this point.

Since the students have only the data from Question 1 at their disposal at this point in the exercise, recommendations are difficult to make. Question 1 data are inconclusive in terms of a recommendation given that there was not complete agreement in either group regarding the existence or non-existence of a littering problem. Also, no data were collected via a survey of the actual amount of litter in the community. Nor were the respondents asked to state the basis for their yes or no responses. The best recommendation at this point would be to collect more data on each of the two situations stated above, i.e., Is there a littering problem in the community? What types of litter exist and where are they located? Why did the respondents answer this question in the manner they did? Exercise IV-11 may elicit a certain degree of frustration on the part of the students, yet the exercise serves as a valuable learning device which reflects the essence of research - that being the idea that often the results of research give rise to further questions and the necessity for further research rather than giving clear cut answers.

Question 5.: What age person do you believe is more responsible for the littering?

Conclusion: Junior high school students believe that all age groups are equally responsible for littering. Adults believe that students of junior-senior high age are most responsible for the littering, and that college aged individuals are the second age group most responsible for littering.

Inferences:

1. Adults have observed littering taking place and can accurately identify the individuals responsible.
2. Junior high school students have observed littering taking place and can accurately identify the individuals responsible.
3. Junior high school students do not hold biased opinions toward any particular age group as the source of littering.
4. Adults hold biased opinions toward junior and senior high aged students as well as college-aged students as the source of littering.
5. Junior high aged students are not aware of who actually litters.
6. Adults are not aware of who is actually littering.

Recommendations:

1. A survey of areas of the community in which litter occurs should be undertaken to determine who is responsible for the littering. This survey should be undertaken in such a way that the litterers do not realize they are being observed.
2. If the results of the above survey indicate that junior-senior high school aged students are responsible for most of the littering, an anti-litter educational program should be instituted within the junior and senior high schools of the community.
3. If the results of the above survey indicate that all age groups litter, an anti-litter educational campaign should be instituted for the entire community.
4. Various other recommendations might flow from the results of the survey done in recommendation 1, including:

   a) increasing the number of refuse containers in areas where littering occurs and b) passing and enforcing a litter law in the community.

Regardless of the recommendations made by the students, the instructor should accept as valid those recommendations that are consistent with the conclusions and inferences from which the recommendation was made.

The above recommendations are premised on the results of a littering survey rather than the opinionnaire. Often one will find it difficult to make sound recommendations from opinionnaire data. It may be very necessary to use a survey to gather data to corroborate or refute the opinions of a sample. This is a most important concept for students. They should be made to realize that in many cases, more than one form of investigation technique must be used in order to obtain data from which valid conclusions, inferences and recommendations can be made.

If in Exercise IV-11, the students can correctly state a conclusion, an inference, and a recommendation utilizing the critical rules governing each, it is an indication that appropriate conceptualization has taken place and that the students can apply the concepts to a new situation. If this conceptualization has not taken place, the instructor is encouraged to have the students collect a set of data and draw conclusions and formulate inferences and recommendations from those data.

MODULE V

INVESTIGATING AN ENVIRONMENTAL ISSUE

It's Your Turn

The time has arrived! It's time for you to investigate an environmental issue of your choice. You will remember that many weeks ago, we told you that you were going to get to choose a specific problem and study it yourself. You should be able to do this now. You have a set of skills that you can apply to a problem of your choosing.

Now you have the opportunity to pick a particular issue and look into it to the extent that you will become an expert on that issue. In what are you interested? Is it a problem connected with the population explosion? With water pollution? Pesticides? Toxic wastes? Energy production? Land use management? An endangered species? Sewage disposal? Wild rivers? Game bird management? Wilderness preservation? Littering? Abandoned autos? Zoning? Urban sprawl? Noise pollution? Soil erosion? Just WHAT is it that looks to you to be important (and interesting) to study?

Remember, whatever it is you choose to study, focus on something that you can be successful with. Choose the right strategy for investigating the problem. And don't - whatever you do - DON'T try to investigate ALL endangered species or ALL of the problems connected with water pollution. That's almost an impossible task. Choose your area of study and define your problem carefully!

Let's see how well you can do with a research question or a problem statement of your own. On these pages you will find the space necessary to write this out. There will also be space for a revision if one is necessary. Good luck!

V-1. THE SPECIFIC PROBLEM OR TOPIC YOU HAVE CHOSEN:

V-2. THE RESEARCH QUESTION OR PROBLEM STATEMENT:

V-3. RESEARCH QUESTION OR PROBLEM STATEMENT EVALUATION: (Your instructor will probably want to discuss this with you at this time. Note any comments or suggestions he/she has in this space.)

V-4. REVISION OF RESEARCH QUESTION OR PROBLEM STATEMENT (If Needed):

V-5. TECHNIQUES I PLAN TO USE IN STUDYING THIS ISSUE: (Check One or More)

Secondary Sources _____; A Survey _____; A Questionnaire _____; An Opinionnaire _____; Other _____ (If "other", please explain.)

V-6. HOW WILL THESE TECHNIQUES HELP ME SOLVE THE PROBLEM I HAVE CHOSEN?

V-7. MY CONTRACT:

Name ________________________

Class ________________ Instructor ________________

Final Research Question or Problem Statement:

I hereby contract with my instructor that I shall use all of my mental ability and those skills in which I have been trained in order to successfully investigate the issue chosen. Further, I guarantee that my independent investigation will be conducted in a manner as to give me pride in myself and to respect the rights of other human beings.

I understand that my research will be evaluated on a raw-score basis and that my final grade for this project will be based on the number of points earned. Further, I have read the following breakdown of criteria and understand how I will be evaluated.

Criteria	Possible Points	Points Earned
Quality of research question or problem statement.	______	______
Techniques used in the investigation.	______	______
Seriousness of approach to the research.	______	______
Quality of data collected.	______	______
Accuracy of conclusions.	______	______
Quality of inferences.	______	______
Accuracy and organization of the final report.	______	______
Class presentation.	______	______
Grand Total	______	______

________________________ Date

________________________ Signature of Student

________________________ Witness

________________________ Signature of Instructor

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

MODULE V

SUGGESTIONS FOR TEACHING MODULE V

There are no objectives or specific guidelines for Module V since the students are engaged in autonomous research within a contract setting. The student reading material is short and to the point. Their task is to choose a topic for investigation, formulate a research question or problem statement, establish the techniques necessary to collect data which will answer the question or problem, and carry out the research. It is the culmination of what they have learned in Modules I-IV. We would suggest that the research in which the student engages should serve as an evaluation of whether he has the skills and can apply those skills to a problem situation. It's not a matter of his choice of research strategies as much as it is whether he can apply the skills inherent in the research strategy chosen.

Some instructors may be quick to criticize the authors if the students have problems while engaged in autonomous research. The writers would like to point out very specifically that they have not guaranteed that the students would be able to function without guidance and input from the teacher. Neither do they guarantee that the student will be able to inductively transfer his skills from the training modules to the autonomous module. Indeed, it is hoped that he can but research points out clearly that transfer takes place most appropriately when it (transfer) is taught. In other words, it may well be appropriate for the instructor to help the student see how acquired skills can be applied to the new and unique situation in which the student finds himself.

The writers WILL GUARANTEE, however, that students who have successfully completed the first four modules WILL succeed in autonomous research far better than students without the modular training. This, of course, assumes that the instructor serves as consultant and "research associate" to the student. Certainly, the instructor need not engage personally in the research, but the student must feel that the instructor perceives the importance and excitement in the research being conducted.

The importance of the teacher during the entire process cannot be underestimated. At the beginning of the module, it is essential that the teacher evaluate the research questions or problem statements posed by the students. Although they have learned the necessary elements of the research question or problem statement, students often tend not to delimit the question or problem to parameters they can handle. Often their questions/problems are too broad or may even be unanswerable. This is the point for the teacher to step in, giving guidance and, by using positive and constructive criticism, redirect the student's research into channels that can be handled. This is the reason for section V-4, Revision of Research Question/Problem Statement.

A second spot to monitor is the student selection of research techniques. Are they appropriate for the question/problem posed? Will a combination of techniques be necessary? Much lost time and student frustration can be averted by an astute instructor who consults with the students at these planning points prior to the actual independent investigation.

TIME ESTIMATES

Time estimates for Module V are very difficult to make since the student is not only in an individualized learning situation but also on a self-paced schedule (time and teacher permitting). Trial testing of the Modules indicated that students will choose a variety of problems on which to do research and that many variables impinge on the speed at which these can be successfully completed. Students must write away for information. Sources are not always prompt in replying. Students cannot always get instant interviews with governmental or other professional people. A needed book may be temporarily out. A trip to another library may be necessary. Producing valid questionnaires takes time. A horde of seemingly impeding problems seem to plague progress. This is a part of the scene and the instructor should anticipate some frustration.

Some students may finish projects and have reports completed within three weeks. Others may take six to eight weeks to complete. A number of strategies can be used to "take up the slack". A student finishing early may be eager to tackle another problem, or, perhaps, take some sort of action based on the findings of his research. Both of these behaviors were noted during initial trial teaching. The teacher may choose to "bring the class together" one day per week, perhaps on a Wednesday, to permit an open discussion of progress and/or problems. Beginning the third week, the teacher may want to schedule research reports for those students having answered their chosen research questions. Of course, the instructor must not evaluate the student on how long it takes him to complete his project (unless, of course, the student's motivation to reach closure is low).

It is questionable whether to "force" a student to do an additional piece of research (given that the initial research was of a quality nature). However, one of the basic characteristics of science is that research normally breeds new questions needing answers. This can be pointed out to the student and the instructor might even go over the student's findings, inferences, and conclusions to help him identify new avenues to probe. One should not expect all students to be self-motivated in the area of environmental problems. This being the case, the instructor may be forced, eventually, to place certain students back into a highly structured learning environment. If this becomes necessary for certain individuals, the teacher should definitely not feel incompetent. It should be recalled that the student may only be influenced by the instructor five hours per week. Many other variables impinge on the student during the remaining hours.

THE LEARNING CONTRACT

Module V is planned to be structured around a contractual agreement with the students. It is the basis for student commitment and also acts as an evaluation framework for the teacher. In the student edition, the authors chose not to place actual numerical values in the "Possible Points" column for each of the project criteria. This is a decision for the teacher to make. However, the reproduction of that contract (on the following page) does have the point values that the authors used while teaching the modules. The values are merely suggestive but do allow you to observe weighting that has been used

V-7. MY CONTRACT:

Name ______________________________

Class ______________________ Instructor ______________________

Final Research Question or Problem Statement:

I hereby contract with my instructor that I shall use all of my mental ability and those skills in which I have been trained in order to successfully investigate the issue chosen. Further, I guarantee that my independent investigation will be conducted in a manner as to give me pride in myself and to respect the rights of other human beings.

I understand that my research will be evaluated on a raw-score basis and that my final grade for this project will be based on the number of points earned. Further, I have read the following breakdown of criteria and understand how I will be evaluated.

Criteria	Possible Points	Points Earned
Quality of research question or problem statement.	10	______
Techniques used in the investigation.	20	______
Seriousness of approach to the research.	10	______
Quality of data collected.	20	______
Accuracy of conclusions.	20	______
Quality of inferences.	20	______
Accuracy and organization of the final report.	25	______
Class presentation.	25	______
Grand Total	150	______

______________________ Date

______________________ Signature of Student

______________________ Witness

______________________ Signature of Instructor on the various criteria.

All evaluation components, except one, directly or indirectly reflect skills developed in the modules. The one not referring to skills on which the student has had at least partial training is that dealing with the seriousness of approach to the investigation. The reader will note that this criterion has been given only a 10 point value. The contract itself is probably a better guarantee of performance than this criterion and if the instructor determines that it should be deleted this should not greatly affect student behavior (if the contract itself is used).

The teacher may be concerned as to why the research question is given only a 10 point value. This is simply because the instructor has already approved the research question and, if it is not worth criterion, the instructor has faulted in his responsibility to help guide the student toward a workable research strategy.

In terms of the class presentation evaluation component, it is the instructor's responsibility to identify the characteristics or parameters that students' should follow in their oral reports. These should be communicated to the students far in advance of the actual presentation. Some guidelines to consider are: clarity of presentation, completeness and accuracy of report communicated, use of audio visual aids, effectiveness of communication, etc. The intent of the oral presentation is to inform the entire class of the issue researched. It can serve as an additional learning activity for the entire class and could serve as a spring board for additional class discussion. Such reports can also serve as topical material for the environmental action module (VI) which would follow the autonomous research project.

THE TEACHER'S ROLE

In the Preface to the Instructor the authors addressed the teacher role which seems to be most effective in achieving student success with the modules. The role does call for a modified style on the part of some teachers. It demands a trusting posture between teacher and students. Coupled with that trust, however, must be a set of high teacher expectations. Research suggests that students tend to achieve to the level of teacher expectations. This being the case, set rational but high quality expectations for your students. If the students have achieved the skills taught in Modules I-IV, they do have the prerequisite abilities to do autonomous research. It is up to the teacher to work with the students in terms of the responsibilities they have as independent investigators, e.g., respecting the rights of others, abiding by school rules. It may be helpful to have a class discussion with the students regarding the rights that they have as they pursue their research and the concomitant responsibilities. There is nothing wrong with making the ground rules clear, but it should be done from a positive standpoint.

It has been the authors' experience that the majority of their students have been excited about and anxious to engage in autonomous research. There have been a few instances where an isolated student has refused to undertake a research project. In those cases, the teacher has chosen not to force the student to do research. Appropriate academic work has been substituted for that student.

During the actual research period, the teacher will act as a consultant, resource person, possibly a liaison between school and community, and most of all an encouraging supporter of the students. The role is a rigorous one demanding energy and attention. However, the payoff of this expenditure is well worth the effort. It is also important enough to mention again that the teacher is in control. There need not be discipline problems and the students do have the ability to investigate issues independently.

MODULE VI

ENVIRONMENTAL ACTION STRATEGIES

Introduction

Many students and adults are unhappy about a variety of environmental problems. But, they don't know how to go about helping to solve these problems. Environmental ACTION is the key to these solutions. Only when citizens have the skills needed to take ACTION will solutions be found for many issues. In Module VI you will have an opportunity to learn how to use most of the strategies involved in environmental action.

If you were successful with Modules I through V, you are certainly an expert in investigating environmental issues. Probably, by now, there are issues in which you have become very interested. As a citizen, you would like to help solve these issues. The skills presented in Module VI will help you do exactly that.

Objectives for Module VI

Following your work in Module VI you will be expected to be able to . . .

1. . . . identify at least two reasons why it is difficult to classify a particular environmental action as passive, positive, or negative.

2. . . . propose one example of an environmental action which could be classified as either positive or negative and defend both of these classifications.

3. . . . define the action method of PERSUASION and identify at least two examples of strategies which could be used in this category.

4. . . . define the action method of CONSUMERISM and identify at least two examples of strategies which could be used in this category.

5. . . . define the action method of POLITICAL ACTION and identify at least two examples of strategies which could be used in this category.

6. . . . define the action method of ECOMANAGEMENT and identify at least two examples of strategies which could be used in this category.

7. . . . identify two advantages of group action which individual action does not have.

8. . . . given any of the thirteen action analysis criteria, explain why an individual should consider these before taking any type of environmental action.

9. . . . given a specific example of an environmental action, apply the thirteen action analysis criteria listed in Module VI.

10. . . . identify a given persuasive action as an emotional appeal, logical appeal, coercion, or combination of these.

11. . . . produce an example of an effective persuasive action on some issue which combines both logical and emotional reasons for taking action and follows the appropriate guidelines for persuasive action.

12. . . . describe the dangers of persuasive actions based only on emotion and give one example of an actual environmental issue in which such actions were taken.

13. . . . identify three different modes of persuasion and explain how each can best be put to use.

14. . . . select a product and perform both an ENVIRONMENTAL COST and a NEEDS ASSESSMENT on the product. Further, a recommendation must be made

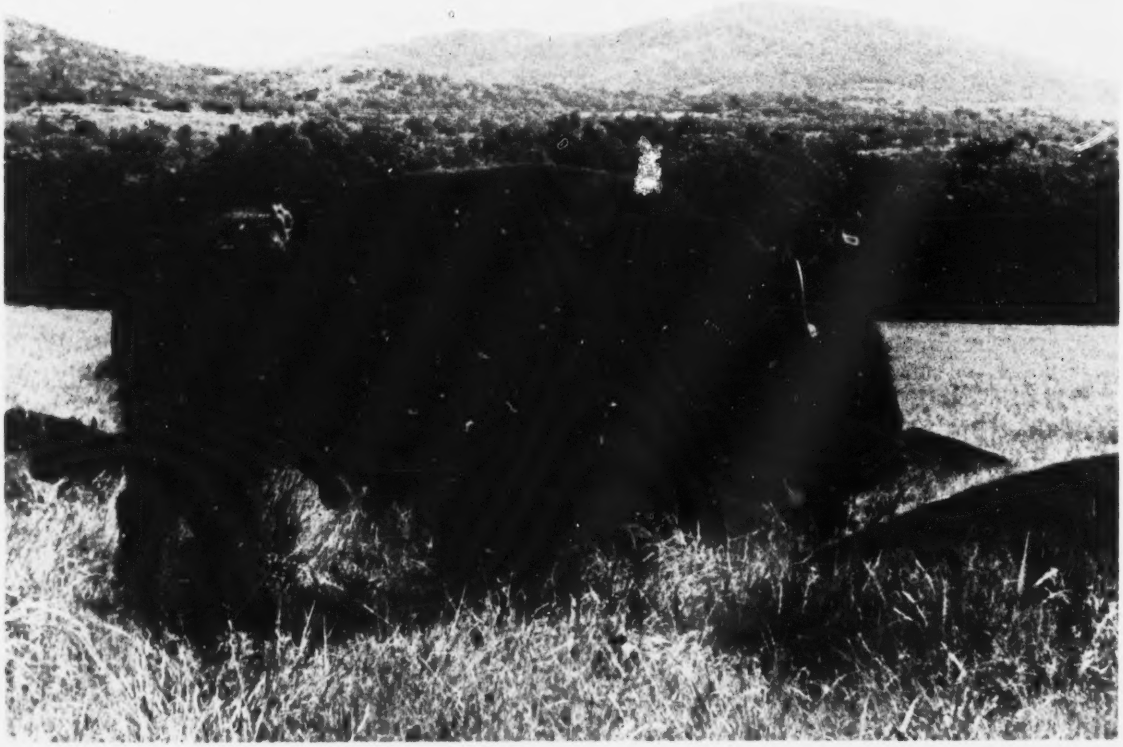
as to whether action should be taken regarding the product.

15. . . . identify three categories of consumer action and describe issues for which each form of action is appropriate.

16. . . . describe three kinds of political action and discuss how each of them may be effectively applied to environmental issues.

17. . . . identify three situations in your area which could require ecomanagment type actions.

18. . . . apply all of the action skills and knowledge in developing a plan for action concerning some environmental issue. This would include identifying and summarizing the issue, identifying and evaluating possible actions, and making a final recommendation concerning action on the issue.



WHAT IS ACTION?

In a quiet, southern Illinois town, a man drives his car across a railroad track and throws a beer can away . . . in Utah, a rancher hires a helicopter and shoots eagles out of the air . . . in Louisiana, a well known official is discovered buying alligator hides from poachers . . . at a Midwestern park, college students entertain themselves by throwing glass bottles against a canyon wall . . . on a back road in Kentucky, a man pulls his pickup truck over to the ditch and calmly pushes an old washing machine into the weeds . . . on the east coast, a utility company lies to the public about the environmental effects of its waste water . . . in Brazil, wild cats are killed, skinned, and the furs smuggled into the United States to be made into coats.

These are a few actual accounts of environmental action. They all appear to have one thing in common. What seems to be common to all of these examples of environmental action? Please respond below: (VI-1)

What are the common elements? ____________________

____

____________________.

It would appear as though many kinds of environmental actions are NEGATIVE - or, not in the best interests of the environment. You say that this is a value judgment on the parts of the writers? Indeed, it is!

There are probably three different kinds of environmental action. These can be classified as follows:

1. POSITIVE ACTION: This would be an action that helps improve or maintain the quality of the environment.

2. NEGATIVE ACTION: This would be an action that somehow decreases the quality of the environment.

3. PASSIVE ACTION: This could just as well be called "no action" because it neither supports or hurts the environment.

Every day each citizen takes one or more of these kinds of environmental action. It's not always easy to decide what the results of an action may be, so sometimes it is hard to classify a particular action. Why is this true? Simply because people often disagree about their personal rights and about the effect of a particular action on the environment.

As you already know, environmental problems are produced because people have CONFLICTING VALUES - those personal rules of behavior which help us make decisions that will gain some desired outcome. On one hand, a man throws his beer can on the railroad tracks - on the other hand, another person believes that this violates his right to have a clean environment. On one hand, an oil corporation president decides that producing less heating oil will force prices up and increase his company's profits - on the other hand, a congressman believes that there ought to be a law against such practices to protect the consumer. On one hand, there are countries in the world that still send whaling fleets to sea - on the other hand, many nations believe that whaling is not necessary and that the great whales should be protected. On and on . . .

Conflicting values are always involved in environmental problems. Because of this, the writers take the position that an environmental action must be weighed in terms of its total effect on the environment. This is not always easy. Perhaps a short exercise will help demonstrate this.

(VI-2) Classifying Actions. As noted earlier, there are three kinds of action: POSITIVE, NEGATIVE, and PASSIVE. Using the symbol (+) for POSITIVE, (-) for NEGATIVE, and (0) for PASSIVE, code each of the following environmental actions in terms of how YOU would classify them. When finished, see if your classification agrees with those prepared by others in the class. If there is some disagreement, why might it exist?

SYMBOL	THE ACTION
____________	1. A college coed goes home for the semester break and leaves her pet dog to roam in the community.
____________	2. A movie star buys a leopard coat costing thousands of dollars.
____________	3. A rural land owner realizes that his old car can't be repaired and pulls it into the weeds behind the barn.

SYMBOL	THE ACTION
	4. A housewife buys pop in nonreturnable bottles.
	5. An apartment renter throws garbage away in a rusted-through garbage can in the alley.
	6. A fisherman buys beer in aluminum cans. They will be tossed into the lake when empty.
	7. A neighborhood gardener makes a compost pile out of grass clippings, fallen leaves, and organic garbage. Sometimes it smells.
	8. In order to get better gas mileage, the neighborhood mechanic bypasses the pollution-control device on his car.
	9. Instead of letting the faucet run to get cold water, an elderly lady keeps a jar of water in her refrigerator for drinking purposes.
	10. A young couple decides that they want a large family because they love children.

Some of the above are tough to classify when the rights of the citizen are weighed against the good of the environment. Yet, these are the kinds of questions that have to be answered by every citizen each and every day.

Just because it is sometimes difficult to classify environmental actions, this does not mean that one should not attempt to do so. It does mean, however, that you should begin thinking in terms of the consequences of action! On the next page you will find one example of one individual's idea of a positive environmental action.

Negative or Positive?

The following is taken from the May 1974 issue of Audubon, page 107. How would you judge this environmental action?

> One man's protest against nuclear powerplants made headlines on Washington's Birthday. Instead of chopping down a cherry tree, Samuel H. Lovejoy - a 27 year old college graduate and organic farmer - toppled a 500 foot tower being built in connection with a $1.3 billion Northeast Utilities nuclear powerplant at Montague, Massachusetts. Unlike the Fox - an anonymous conservation commando who committed acts of vandalism against polluting industries in the Midwest but was never caught - Lovejoy made his point by cutting the guy wires that held up the tower and immediately surrendered to police. In a four-page typed statement, he took full responsibility for the sabotage, which he hoped would set people to thinking about the dangers of nuclear power. He did elicit reactions: Many young people were for him; most conservative New Englanders were shocked, and conservation groups deplored this kind of protest and disassociated themselves from it.

What do YOU think? Positive? Negative? Passive (neutral)?

You and Action: Important Ideas

This module is designed to help you learn about and develop skills for taking environmental action. In the process of designing this module, the writers have taken for granted certain ideas which should be shared with you. These are:

1. You have the right to be heard and to act on environmental issues.
2. You have knowledge of environmental issues and may wish to take some sort of action concerning them.
3. No one should force you to take an action against your will.
4. You have the ability to investigate environmental problems and get enough information on which to base a plan of action.
5. Most of the actions you might take have some environmental consequence. You have the responsibility to decide whether an action will be positive or negative over the long run.
6. You have the ability to become skilled in at least some of the methods of environmental action.

The Methods of Action

If you agree with the ideas listed above, you will want to know something about the METHODS of environmental action. If we analyze all of the available strategies for action, we find that many of them can be grouped under four headings. These follow:

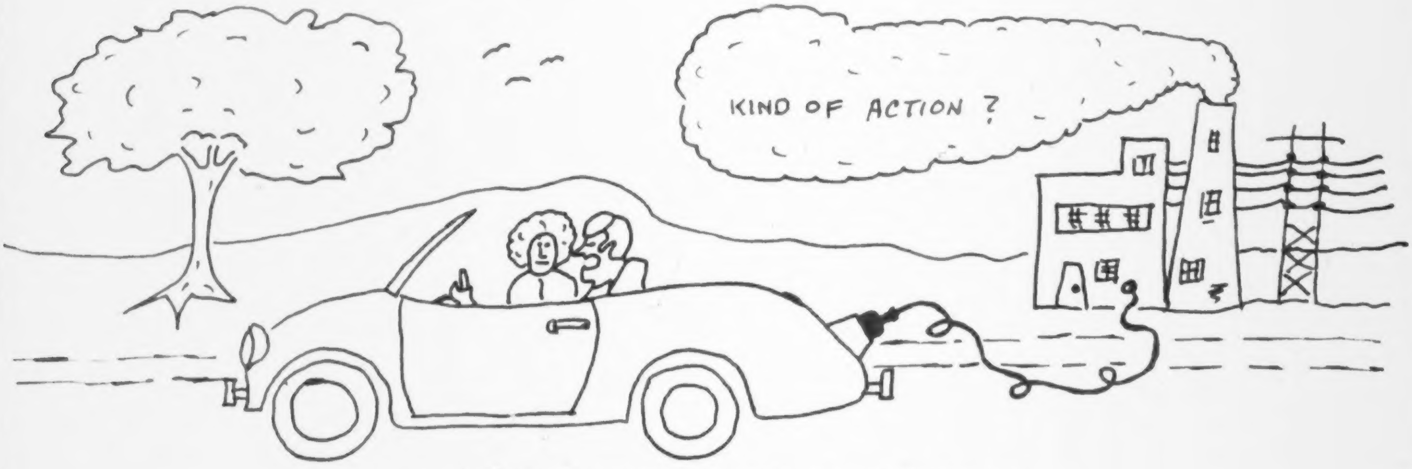
Action Method I - PERSUASION: PERSUASION is used when someone or a group of people is trying to convince others that a certain course of action is correct. How many times in your life have you tried to convince someone that your position is the right position? This takes PERSUASION to be effective, particularly if that person or group doesn't agree with you at first.

Action Method II - CONSUMERISM: CONSUMERISM relies on the power of the pocketbook or billfold. It involves buying something that agrees with one's philosophy or NOT BUYING something that represents an action or an idea one disagrees with. Consumerism is particularly effective if a group of people get together to take action. Even so, some individuals act alone in this dimension. Examples of consumerism? Refusing to buy soft drinks unless they are in returnable bottles. Refusing to purchase articles made in a foreign country that supports a negative environmental policy. Buying products made by companies who try to reduce environmental pollution.

Action Method III - POLITICAL ACTION: POLITICAL ACTION refers to any mode of action that brings pressure on political or governmental agencies and/or individuals in order to persuade them to take positive environmental action. In democratic nations, political action usually means supporting candidates who have positions similar to your own. It means pressuring people in office with letters, telegrams, and phone calls. It means casting a vote for or against a particular issue . . . and more.

Action Method IV - ECOMANAGEMENT: ECOMANAGEMENT is simply a word used to describe any PHYSICAL ACTION taken with respect to the environment. It can be illustrated by examples ranging from picking up someone else's litter to helping a private agency buy and preserve an ecologically-important forest. Ecomanagement, hopefully, results in either maintaining a good environment or improving a weakened environment.

These four methods of action are the ones that will be considered in more detail later. However, before getting into these methods in depth, there are some other things to consider.


KIND OF ACTION ?

I HAD IT CHANGED OVER TO ELECTRICITY IN ORDER TO CONSERVE GASOLINE!!

Individual vs Group Action

Each of the methods described above may be put into practice in one of two ways. These are: 1) by individual action and, 2) by group action.

We have often heard people say, "I can't do anything about environmental problems because I am just one person!" This is not true! There are many ways for the individual to take action - alone or by cooperating with private and public organizations. It IS true, however, that an individual cannot do ALL things. It is also true that an agency cannot do all things. It takes both!

In any event, both individuals and groups can take all four of the modes of action described earlier. Again, these are persuasion, consumerism, political action, and ecomanagement.

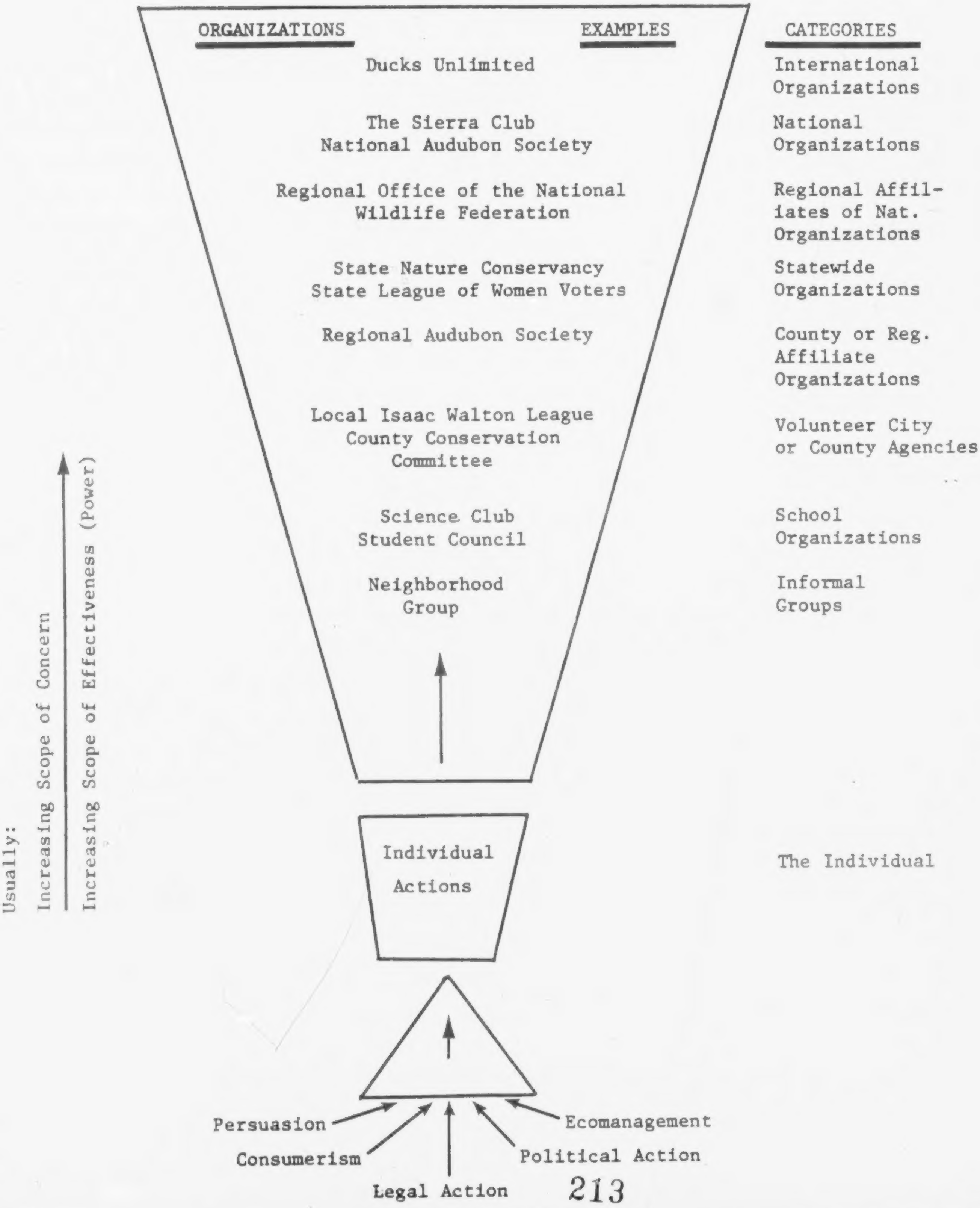
On the next page, you will find a diagram. It shows different LEVELS of environmental action - from individual action through the group action sponsored by international organizations. As you read upward, you will find that the actions (and groups) represent larger and larger regions. This also shows that the scope of the action also increases. However, this is not always true. There are times when the action of one individual or the actions of one small group can have greater impact than the actions of larger organizations. Generally, though, it is true that the most power for action lies with well-organized and powerful groups.

It is also important to realize that groups are nothing more than individuals working together. Even international organizations such as Ducks Unlimited, get their power to act from individual human beings - some 150,000 of them. Organizations are no better or effective than the sum total of INDIVIDUALS belonging to that group. An organization can be a school student group or a national conservation group.

Many people are active both as individuals and as members of groups. Membership in environmental action groups has advantages other than broadening the individual's scope of action. For example, one function of most environmental groups is to keep the individual members well informed on important environmental issues and to provide suggestions for appropriate action. This benefit alone increases the effectiveness of the individual wishing to take action. Paying dues or making donations to action groups also helps. This

Levels of Environmental Action and Decision-Making

Individual and Organizational



ORGANIZATIONS EXAMPLES	CATEGORIES
Ducks Unlimited	International Organizations
The Sierra Club National Audubon Society	National Organizations
Regional Office of the National Wildlife Federation	Regional Affiliates of Nat. Organizations
State Nature Conservancy State League of Women Voters	Statewide Organizations
Regional Audubon Society	County or Reg. Affiliate Organizations
Local Isaac Walton League County Conservation Committee	Volunteer City or County Agencies
Science Club Student Council	School Organizations
Neighborhood Group	Informal Groups
Individual Actions	The Individual

Usually:
Increasing Scope of Concern
Increasing Scope of Effectiveness (Power)
Persuasion
Consumerism
Legal Action
Political Action
Ecomanagement

allows the individual to support action strategies which a person could not take alone because of limited personal skills or financial resources.

Even so, it is not the intent of the writers to tell you that you should be active either as an individual or as a group member. The intent, instead, is to let you know how to be active and to give you the necessary skills. The rest is up to you!

Guideposts for Decision Making

Many people take environmental action - both negative and positive - without the least knowledge of where their actions will lead. This is unfortunate because one should not get on any bandwagon before thinking it through.

How does a person make a decision about whether to take an action? It's not particularly easy if done right.

Let's assume that you want to take action on an issue. Can you think of some questions concerning the action that you ought to ask yourself before taking action?

A few spaces are provided below. Write down questions that you think need answering before any action is taken. (VI-3)

1. ____

____?

2. ____

____?

3. ____

____?

4. ____

____?

5. ____

____?

Please Help !
DEPOSIT YOUR ALUMINUM CANS
HERE
THE EVERGLADES COMMUNITY
DEVELOPMENT ASSOCIATION
EVER
Choice

Recycling Cans in Florida (Photo courtesy H. R. Hungerford)

Many environmentalists would argue that recycling aluminum cans is not as effective as using returnable bottles in the first place. Returnable glass bottles require less energy to make, use a more abundant resource (sand), and reduce the litter problem. Producing cans from aluminum ore has a very high environmental cost in terms of energy and this cost is reduced considerably by using recycled aluminum. Until returnable bottles replace aluminum cans on the market shelf, the environmental actions shown in this photo are necessary to lessen the many problems created by cans.

Do you have a recycling center or pick up facility in your community? What environmental actions do you think might reduce the "metal can problem" in your area?

Action Analysis Criteria

The authors have identified a total of thirteen questions that seem important to ask before proceeding with an environmental action. See if your's agree with those that follow:

1. Is there SUFFICIENT EVIDENCE to warrant action on this issue?
2. Are there ALTERNATIVE ACTIONS available for use? What are they?
3. Is the action chosen the MOST EFFECTIVE one available?
4. Are there LEGAL CONSEQUENCES of this action? If so, what are they?
5. Will there be SOCIAL CONSEQUENCES of this action? If so, what are they?
6. Will there be ECONOMIC CONSEQUENCES of this action? If so, what are they?
7. Do my PERSONAL VALUES support this action?
8. Do I understand the PROCEDURES necessary to take this action?
9. Do I have the SKILLS needed to take this action?
10. Do I have the COURAGE to take this action?
11. Do I have the TIME needed to complete this action?
12. Do I have all of the OTHER RESOURCES (other than the above) needed to make this action effective?
13. What are the ECOLOGICAL CONSEQUENCES of this action?

Have you identified a question that is not on this list that should be asked by someone who intends to take action? It might be an excellent one if you have. Discuss it with your classmates and your instructor.

It is important to decide whether each mode of action should stand the test of these questions. How do you feel about this? On the basis of what you now know, ask yourself whether actions grouped under persuasion, consumerism, political action, and ecomanagment should stand the test of these questions.

On the next page you will find four columns of spaces. Beside each row of spaces you will find the question. Put a check in each space that seems to apply. (VI-4)

* - Persuasion

  * - Consumerism

    * - Political Action

      * - Ecomanagement

The Questions

____ ____ ____ ____ 1. Is there sufficient evidence to warrant action on this issue?

____ ____ ____ ____ 2. Are there alternative actions available for use?

____ ____ ____ ____ 3. Is the action chosen the most effective one available?

____ ____ ____ ____ 4. Are there legal consequences of this action?

____ ____ ____ ____ 5. Will there be social consequences of this action?

____ ____ ____ ____ 6. Will there be economic consequences of this action?

____ ____ ____ ____ 7. Do my personal values support this action?

____ ____ ____ ____ 8. Do I understand the procedures necessary to take this action?

____ ____ ____ ____ 9. Do I have the skills needed to take this action?

____ ____ ____ ____ 10. Do I have the courage to take this action?

____ ____ ____ ____ 11. Do I have the time needed to complete this action?

____ ____ ____ ____ 12. Do I have all of the other resources needed to make this action effective?

____ ____ ____ ____ 13. What are the ecological consequences of this action?

____ ____ ____ ____ 14. Your's, if different from the above: ____________________

____

____?

Did you leave any of the blanks unchecked? If so, why did you choose to do so?

Applying the Questions: (VI-5) Earlier in this module, there is a report of how one man protested the building of a nuclear power plant. Pretend that YOU are Mr. Lovejoy and the time is a few weeks before you plan to topple the 500 foot tower. You come across the action analysis criteria questions. Ask each of these questions in terms of what you are thinking about doing - destroying the tower. What might the answers look like? Do you still think you would go ahead with your plan? Why?

Your instructor may provide you with additional action problems for you to inspect by applying the criteria questions. In any event, the writers hope that these questions make sense to you. They also hope that you will use these questions when you think about taking an environmental action.

Putting Up Bluebird Boxes in Southern Illinois. (Photo courtesy of H. R. Hungerford.)

The eastern bluebird is threatened with extinction due to a loss of nesting habitat. However, the bluebird is slowly increasing its population. Student groups such as this one have helped in the comeback of bluebirds by building and installing nest boxes in appropriate places.

What type of environmental action is this? Is there a need for a similar project in your area? How could you find out?

A Closer Look at the Modes of Action

ACTION METHOD I - Persuasion as an Environmental Action

Persuasive action is a part of almost every environmental action. An environmentalist must first select an action he/she feels is necessary and correct. Then, others must be persuaded to join in the action so that it can be effective. People can be convinced to take a specific action by appealing to their sense of logic and/or some emotion. Sometimes legal action is used to force (coerce) people who cannot be persuaded.

Taking persuasive action of all three types places a heavy responsibility on the environmentalist. Whoever takes action must be sure that the reasons for taking action are sound and in the best interests of all concerned. Let's take a closer look at the three approaches to persuasive actions: LOGICAL, EMOTIONAL, and COERCIVE.

Making Logical Appeals

Persuasive actions of this type have long term effects, but are perhaps the most difficult to carry out successfully. Presenting a set of facts requires that the logic used be well thought out and accurate. The logic must also be presented in a clear and convincing manner. Also, it must be remembered that what is reasonable to you may not be reasonable to someone with a different set of values or a different educational background.

This type of conflict between values is very clear in the nuclear power issue. Nuclear power has been proposed as a safe, clean, and available source of electricity. Environmentalists have often taken the position that nuclear power is not clean because it adds small amounts of radioactive waste to the air and builds up solid radioactive wastes which must be disposed of. Environmentalists also point out that an accident in a nuclear power plant could have catastrophic results in death and damage, even though the chances of such an accident do seem small.

Both sides in this issue are dealing with the same information (data). In the final analysis, the differences lie in values. Therefore, the logical arguments the two sides make with the same data are different ones. Those who desire the energy and economic security of nuclear power are willing to run the risks of ecological problems. Most environmentalists prefer the risk of economic problems over ecological ones.

Unless new and important information becomes available on issues such as this, persuasive action will be difficult for either side.

Making Emotional Appeals

There are cases where environmentalists (or other activists) feel strongly that their action is a positive and logical one, but for various reasons choose to use an emotional appeal rather than a logical one to persuade others. For example, an environmentalist may feel that an issue is too complicated for many people to understand. Yet, he/she wants these people to participate in the chosen action. Another reason for emotional appeals is that time is too short for a thorough, logical treatment of the issue.

Used by itself, an emotional appeal can be a very effective -- but dangerous - means of getting immediate actions by some people. The danger occurs when activists use such tactics to serve their own selfish or poorly thought out purposes.

It would be nice to believe that emotional appeals are ineffective because people do not take actions without carefully thinking them through. Unfortunately, this is not the case. People often take action without giving the matter enough thought.

Few areas of environmental concern are as filled with emotion as the area of endangered wildlife. One good example of this is the issue of protecting feral (wild) burros in the California desert. Feral burros are the offspring of burros which escaped from early prospectors and travelers in the early 1800's. By the 1900's the burro population had risen to a high level and some people began to hunt them for use as commercial dog and chicken food. The killing of these "sweet and innocent" animals produced an emotional outrage among many animal lovers. A strong appeal was made to officials to pass laws protecting the burros. Eventually this emotional appeal succeeded.

This decision was, however, a bad one ecologically. The California desert is a very delicate ecosystem. It has taken the desert plants and animals thousands of years to become adapted for life there. One of the large native animals of the desert is the bighorn sheep. It has feeding habits which cause it to travel over a large part of the desert. This traveling prevents one area or one type of desert plant from being eaten too heavily. Also, this animal has a low rate of reproduction which keeps its numbers low.

The burro is not a native of the desert. It does not have habits which help protect the desert in which it lives. It has few, if any, natural enemies. The large burro population is causing the bighorn sheep to disappear by competing for its food. It is also destroying the desert ecosystem as well. This is definitely a serious environmental issue. It is also one where there is a good deal of emotion on both sides.

Other emotional issues involve the wild mustangs of Nevada, the harvesting of young seals in the arctic, the killing of elk in Yellowstone National Park, and protecting the elephant herds of Africa. In many cases the need for protection is real! However, there is obvious danger in acting on the basis of emotional persuasion without getting all of the facts. These kinds of issues show how important it is to consider all of the facts when selecting environmental actions.

Coercion

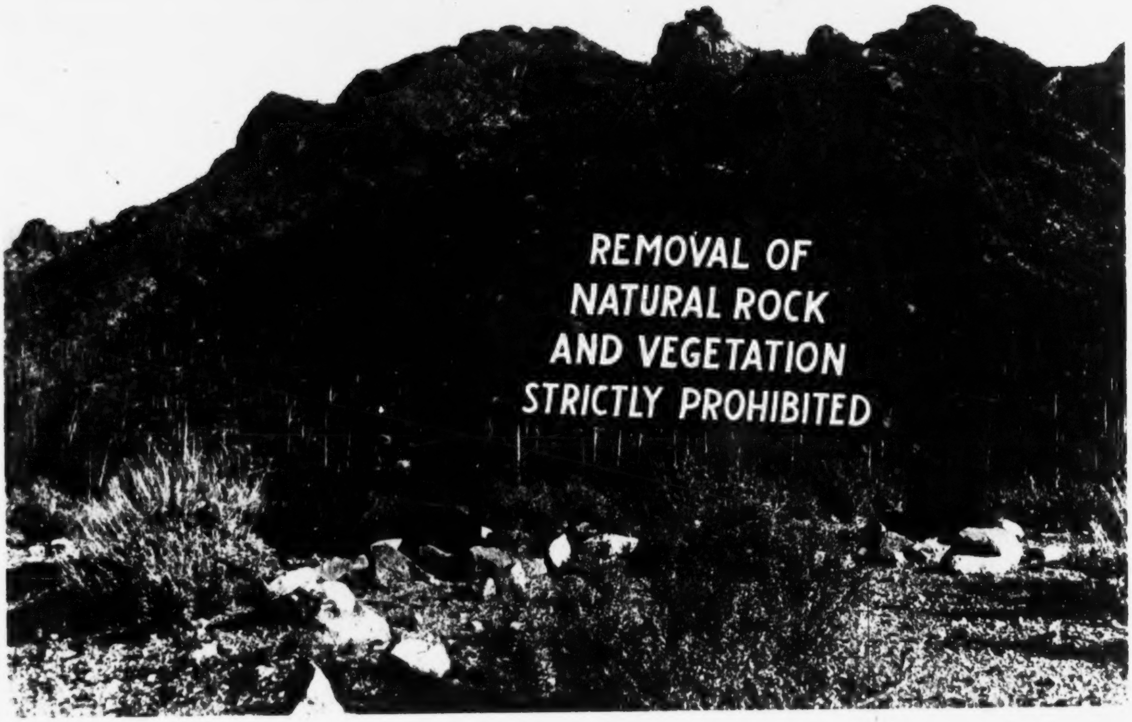
Coercion is not really persuasion since it forces people to act in certain ways instead of allowing them to make their own decisions. However, it is discussed here briefly because it is sometimes used.

There are always some people who cannot be persuaded to act in the best interests of others unless they are forced to do so. For this reason, societies have laws and punishments to coerce the correct or desired behavior.

Environmentalists can use such laws to force others to take positive environmental actions. Other types of actions such as consumer boycotting also may be used to coerce others. (Consumer boycotting will be discussed later in this module.) Coercion, when used, can have serious consequences. Because of this, it is important that the person planning to use coercion checks the action against the thirteen criteria questions seen earlier.

The Best Approach to Persuasion

The authors feel that the best approach to persuasive action is a logical argument which helps others decide to take positive environmental



Desert Near Tucson, Arizona. (Photo courtesy H. R. Hungerford.)

What type of persuasive action is being used here to try and prevent people from taking a negative environmental action? Since several thousand visitors come to this area each year, what would be the effect if each person took home a cactus plant and a rock?

There are some interesting questions that could be asked about this situation. Why is it necessary for park officials to put this sign up in the first place? Many people visit this area without taking rocks or plants. Why don't all people leave the rocks and plants where they are? What would have to be done to permit these kinds of signs to disappear from public places? Will this ever happen? Why?

action. Certainly, presenting a logical case is more effective if it is made in such a way that it appeals to the values (or emotions) of others. However, logical reasons should always be considered as well as emotional reasons for taking action.

Whatever persuasive action you choose, it probably will deal with one or more of the following strategies:

1. Making others AWARE of the need for action.
2. Helping others UNDERSTAND the need for action.
3. Getting others to VALUE the need for action.

To illustrate these stages as they lead to action, consider the issue of high phosphate detergents. Many housewives used detergents containing large amounts of phosphates which eventually fertilized rivers and lakes, causing an overproduction of plants. (This process is called EUTROPHICATION.) Eventually, this process caused severe water pollution problems.

In the late 1960's environmentalists began a campaign to make people AWARE of the problem. The next step was to help housewives UNDERSTAND the biological and chemical nature of the problem and to point out alternatives. Another part of the campaign told of the VALUE of clean water in our lakes and streams. As a result of this persuasive campaign, many people boycotted high phosphate detergents and manufacturers began looking for less damaging detergents to put in the supermarkets.

This is not the entire phosphate story, nor did environmentalists use only these kinds of actions. However, it does serve to illustrate the stages of persuasive action. Again, the key words are AWARENESS, UNDERSTANDING, and VALUING.

Many different methods exist which can be used at each of these three stages. A brief description of how some of these may be used follows:

> _Posters_, _newspaper ads_, _radio announcements_, _etc_.: These are usually brief, eye-catching modes which serve best at the AWARENESS level. They may also be used to appeal to the VALUES of others. Their effectiveness in providing extensive UNDERSTANDING of the issue is limited.
>
> _Verbal discussions_, _speeches_, _letter writing_, _debates_, _newspaper and magazine articles_, _etc_.: These modes are useful at ALL

Pond Eutrophication. (Photo courtesy H. R. Hungerford.)

This closeup of a part of a pond shows the effects of fertilization on the growth of algae. Fertilizer in the form of nitrates and phosphates washed into this farm pond. The dense mats of green algae and the other small organisms in the murky water are the result of these chemicals in the water. When the algae die what do you think will be the effect on the oxygen supply in the pond? The decay of dead plants uses up a lot of oxygen. What could happen to the fish population? Are there any bodies of water in your area which are the victims of this form of pollution? If so, what could be done about it?

THREE STAGES, especially in presenting the facts on an issue.

Modeling behavior: When one person takes action and others observe the action, it may serve to persuade them to do likewise. Picking up litter or using trash cans in the hallway would be an effective example of modeling behavior. This method can serve very well to make others AWARE of an issue, and even to make them check their own VALUES.

Guidelines for Persuasive Action

There are some guidelines which should be followed to make persuasive action more effective. If you can add others, write them below in the spaces provided.

1. Be sure the basic argument can be easily understood by those being persuaded.
2. Be certain the case being presented is accurate, and the facts are correct.
3. Show how the desired action fits the values of others.
4. Select a method of persuasion which is clear, interesting, and appropriate to the issue.

Can you add others?

5. ____

____.

6. ____

____.

Writing Persuasive Letters

To refresh your memory on good letter writing, refer back to Module II. The general form of the persuasive letter is the same. Since letter writing is a common form of persuasive action when trying to get good environmental laws passed, the following guidelines are suggested for use when writing politicians. You may want to keep some of these in mind when writing persuasive letters to others as well.

1. Begin the main body of your letter with Dear Senator ______, Dear Representative __________, or Dear Governor ___________.

2. In the first sentence, state the issue and how you wish the legislator to vote on the issue (or, in the case of a governor, how you want him/her to react to a proposed law). When referring to a specific bill, be sure to use its name and number.

3. It is best to limit each letter to a single issue.

4. Present the issue as briefly as possible. Describe your position and why you hold it. If you have detailed information to provide, organize the letter so that the reader does not have to wade through this in order to understand the meaning of your letter. Often, it is best to attach detailed descriptions to the letter as appendices.

5. Never include disrespectful comments. Do not begin with statements like, "I know you won't read this but . . ." Be objective and courteous, never threatening.

6. Express your pleasure with any positive actions taken by the legislator or official. Often it is wise to devote a whole letter to praising some action taken which represents your interests. This lets the legislator or offical know that he/she is on the right track.

7. Include a full return address so the legislator can respond.

(VI-6) Classifying Actions: Refer back to the story of Sam Lovejoy and the "Fox", reprinted earlier in this module. While the actions of these two may be ecomanagement actions, they are also of a persuasion type. Classify the persuasion approaches taken by these two people. Classify them as LOGIC, EMOTION, or COERCION. Defend your choice of classification.

Sam Lovejoy - Type: ______________________________

Defense: ______________________________

____

The "Fox" - Type ______________________________

Defense: ______________________________

____

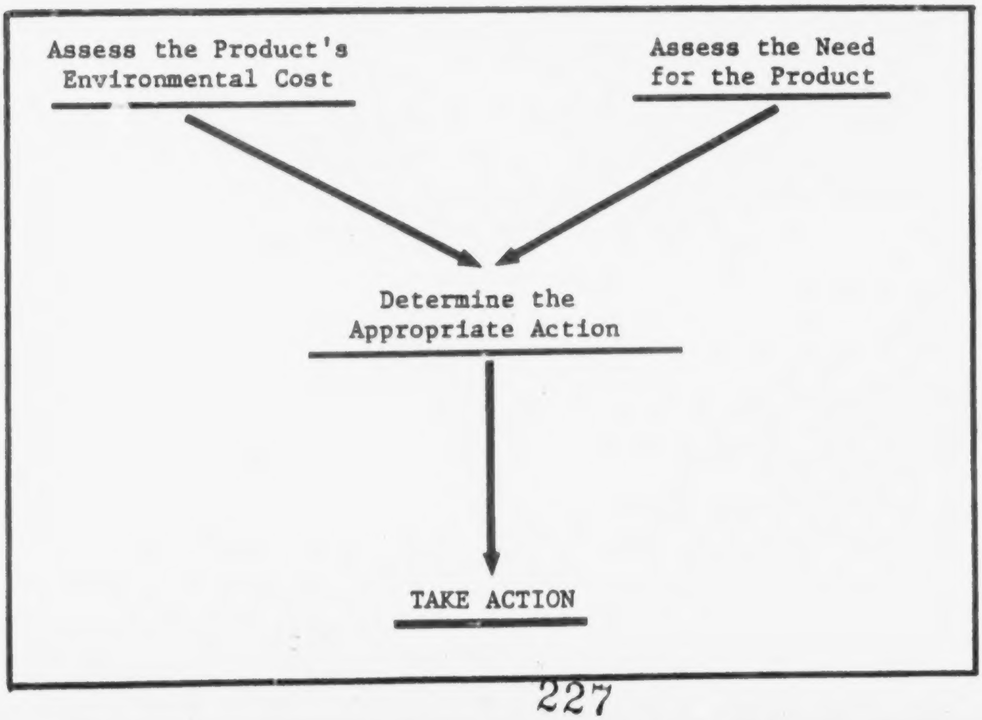
ACTION METHOD II - Consumer Action.

As consumers of services and products, we take consumer actions every day which affect the environment. Consider the following list of products. Most of these you probably use at least occasionally.

1. Pop in disposable cans.
2. Electric hair dryers.
3. Plastic sandwich bags.
4. Automobiles.
5. Refrigerators.
6. Hamburgers in disposable containers.

Certainly, you could add many other products to the list which you consume and/or use. Are the effects of these products on the environment negative or positive?

Actually, it is nearly impossible to classify a product as completely good or bad for the environment. Instead, a comparison must be made between the harmful effect the product has on the environment (ENVIRONMENTAL COST) and the NEED for the product. The flow chart which follows suggests an approach which can help in selecting a positive consumer action.


Assess the Product's Environmental Cost
Assess the Need for the Product
Determine the Appropriate Action
TAKE ACTION

Assessing the Environmental Cost of the Disposable Pop Can

Assessing the damage a product may do to the environment is not an easy task. To help in making an assessment of environmental cost, a list of questions is presented below. Consider each of these. As an example of how the questions may be used, they are applied to the disposable pop can.

1. Is the product made from natural resources which cannot be renewed?

   FOR POP CANS: Pop cans are made from aluminum and steel. Since metals cannot be replaced once they are mined from the earth, the answer is a definite YES, they do require nonrenewable resources.

2. When the natural resource is taken from the environment, does it damage the environment in any permanent and undesirable way?

   FOR POP CANS: Metal ore for producing cans must be mined. Mining operations always have a measurable effect on the environment. The wastes produced by the mine may pollute water ways. The earth is often scarred permanently. Of course, there is also the matter of the energy it takes to remove materials from the earth. The answer is usually YES.

3. If the change (damage) is not permanent and can be repaired, is it being repaired?

   FOR POP CANS: Unfortunately, much of the damage remains because reclamation (recovering the mined land and cleaning polluted waters) is so expensive. Thus, the answer is usually, NO.

4. Does the manufacture, transport, and/or storage of the product damage the environment?

   FOR POP CANS: The transport of canned pop is no more destructive to the environment than transport of bottles. However, the manufacture of pop cans causes pollution - air as well as water - and uses tremendous amounts of energy. This is especially significant, since the can is intended to be used only once.

Several years ago it was calculated that transporting pop and beer containers exceeded the combined energy needs of fifteen (15) countries in Africa, Asia, and Central America. Throwaway cans require three times as much energy as returnable bottles to make, use, and dispose of. The answer, then, is YES.

5. Does the use of the product damage the environment?

FOR POP CANS: The actual "use" of the can does not. The answer is NO.

6. Does the disposal of the product after use pose a problem for the environment?

FOR POP CANS: This is one of the biggest problems with pop cans. Americans consume over 380 soft drinks per person per year. About 65% of these come in non-returnable cans and bottles. That means that millions of cans will end up either as litter in the environment or as solid waste in a landfill or other garbage dumps. The answer is YES.

Pop Can Assessment Summary

A summary of the pop can assessment might appear as follows:

Question	Cost Assessment of Cans
1. (Resource use)	High
2. (Mining)	High
3. (Reclamation)	High
4. (Manufacture/transport)	Very High
5. (Use of product)	None
6. (Disposal of product)	Very High

Total Assessment Decision

The pop can represents a *high cost* to the environment.

Assessing Product Need

Even when an environmental cost assessment has been made for a product, a consumer decision cannot be made until the need for the product has been determined. Below are three guidelines for assessing product need. After you have read and thought about them, apply the guidelines to determine your need for pop cans.

Guidelines for Assessing Product Need

1. Does the product serve a real need? Or, an imagined need?

2. Are there environmentally desirable substitutes available (or, at least less damaging ones)?

3. Do you value the benefits of the product more than the costs to the environment?

(VI-7) Assessing the Need for the Pop Can: Answer each of these questions with respect to your personal need for the pop can. Some space has been provided for your reasoning.

Question 1: Does it serve a real need? _____. An imagined need? _____.

Your reasoning: ____

____.

Question 2: Is there an environmentally desirable substitute available?

_____. Your reasoning: ______________________________________

____

____.

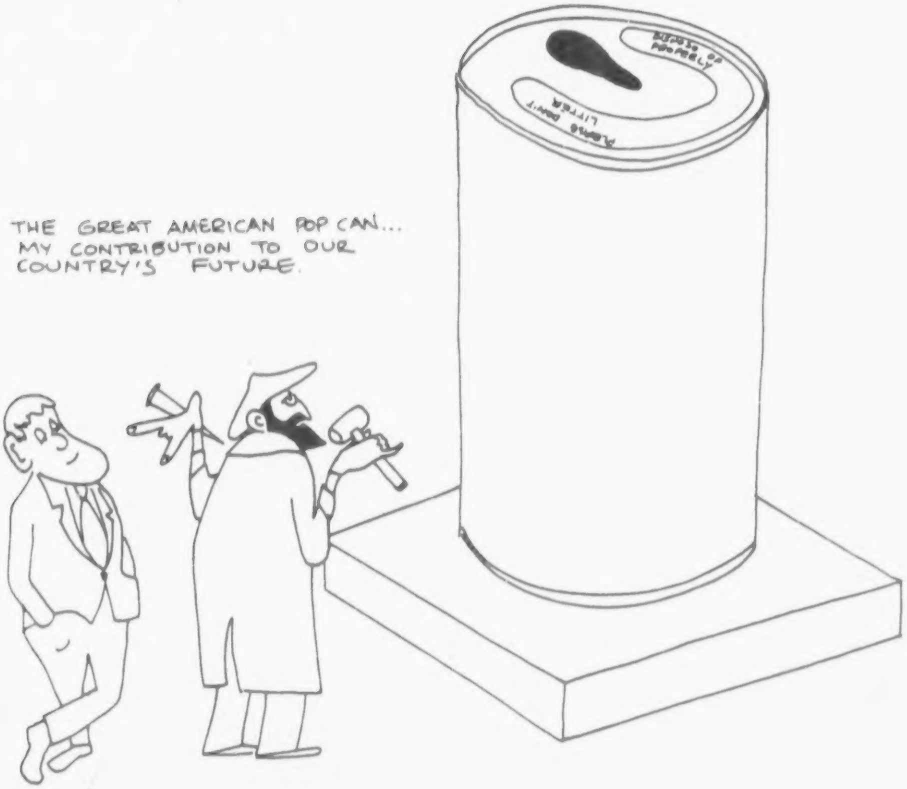
Question 3: Do you value the benefits of the pop can more than the cost to the environment? _____. Your reasoning: ________________________

____

____

____.

How do your responses compare to those of others in your class? Do your responses reflect your values in any way? How about the values of your classmates? How?


DISPOSE OF PROPERLY
PLEASE DON'T LITTER
THE GREAT AMERICAN POP CAN... MY CONTRIBUTION TO OUR COUNTRY'S FUTURE.

Types of Consumer Action

Most consumer action can be classified under three headings: DIRECT BOYCOTTING, CONSUMER CONSERVATION, and INDIRECT BOYCOTTING. Let's briefly consider each of these and how they could be applied.

Direct Boycotting: BOYCOTTING means to avoid buying certain products for some reason. In this case, a product is avoided because it has been found to cost the environment more than it is worth. Non-returnable pop bottles, for example, have been found to have a high environmental cost. Since there are acceptable substitutes (returnable bottles) which have a much lower environmental cost, the need for non-returnable bottles is not really high. In this case, an environmentally concerned citizen would avoid buying pop unless it was in returnable bottles. If enough consumers did this, soft drink manufacturers would be forced to produce more of the ecologically sound returnable bottles and discontinue the others.

Consumer Conservation: In some instances, a product may be found to have a very high environmental cost, but also a high needs assessment. A total boycott would not be an acceptable environmental action because of social, economic, ecological or other consequences. An example of such a product is electrical energy.

Our society could not function without electrical energy. Yet, the effects of energy production on the environment are great. Whether electrical energy is produced from oil, coal, gas, or nuclear fuel, serious problems are created in the environment. These problems arise from mining, transportation, and/or air and water pollution.

An environmentalist conserves energy by using only what is necessary. Ways to prevent waste are investigated and used. This is CONSUMER CONSERVATION.

Indirect Boycott: When a consumer uses direct boycotting, it is to eliminate the environmental cost of the product itself. However, boycotting a product can also be used to bring pressure on a company or individual to take an action other than with the product itself (INDIRECT BOYCOTTING).

For example, environmentalists boycotted all Japanese goods in an effort to convince Japan that the harvest of endangered whales should stop. This action was known as the "Save the Whales" boycott and helped convince Japan to consider changing its whale harvest procedures.

ACTION METHOD III - Political Action

Environmentalists are finding that some of the most effective actions they can take are political ones. Many decisions which influence our environment are made by government. Politicians must strive to consider all interests and values in finding the compromise answers which will be best for the most people - now and in the future.

Environmentalists can help to make sure their interests and values are considered by taking an active part in the political decision-making process.

Essentially, POLITICAL ACTIONS involve the skills and tactics of PERSUASION which was discussed earlier. The key is knowing how, when, and where to apply those persuasion skills in the political system. This requires a good understanding of how the political decision-making process works at the local, state and federal levels.

Some of the major political actions which could be taken and a brief discussion of them is presented below:

> Voting: This is the most obvious and easily used political action. When environmentalists organize their votes they can elect representatives who have environmental interests, or get officials out of office who have shown no concern for the environment.
>
> Campaigning: Organized environmentalists have shown themselves to be very influential when they campaign for or against the election of some individuals. Political campaigning may involve the donation of time, money, or other resources to influence the election process.
>
> Lobbying: Lobbying is the term used to describe actions you might use in trying to persuade politicians to make a specific decision. Lobbying actions can involve contacting politicians by letter, telegrams, or in person to persuade them to vote for or against a proposed bill. When lobbying efforts are organized, these campaigns are very effective.
>
> Another form of lobbying is hiring individuals who spend all of their time trying to influence politicians. Most large industries and organizations have full-time lobbyists. However, only a few environmental groups have enough money to afford professional lobbyists.

All forms of political action are important means of maintaining or improving the environment. To be able to use these actions effectively, you must be knowledgeable about the political process. This means using sources of information which will keep you informed on the law-making process, the environmental values of politicians running for office, and important issues which are currently being considered by government. Public news media (T.V., radio, newspapers) can keep you informed. Another vital source of information are environmental organizations such as the National Audubon Society, the Sierra Club, or the National Wildlife Federation. These groups often organize letter writing lobbying campaigns which can make your individual effort more effective.

ACTION METHOD IV - Ecomanagement.

ECOMANAGEMENT requires a positive physical action which will improve or maintain some part of the environment. The selection of the action should involve careful consideration of the thirteen criteria questions. For example, some people might feel that damming a small stream to produce a pond would be an improvement in the environment. However, a close look at the ecological consequences may show more harm than good.

Below is a short list of economanagement actions that you might wish to consider. As you read the actions, check off those you feel might be used in your own community or region. If you think of others, add them on the lines provided. Many are possible! (VI-8)

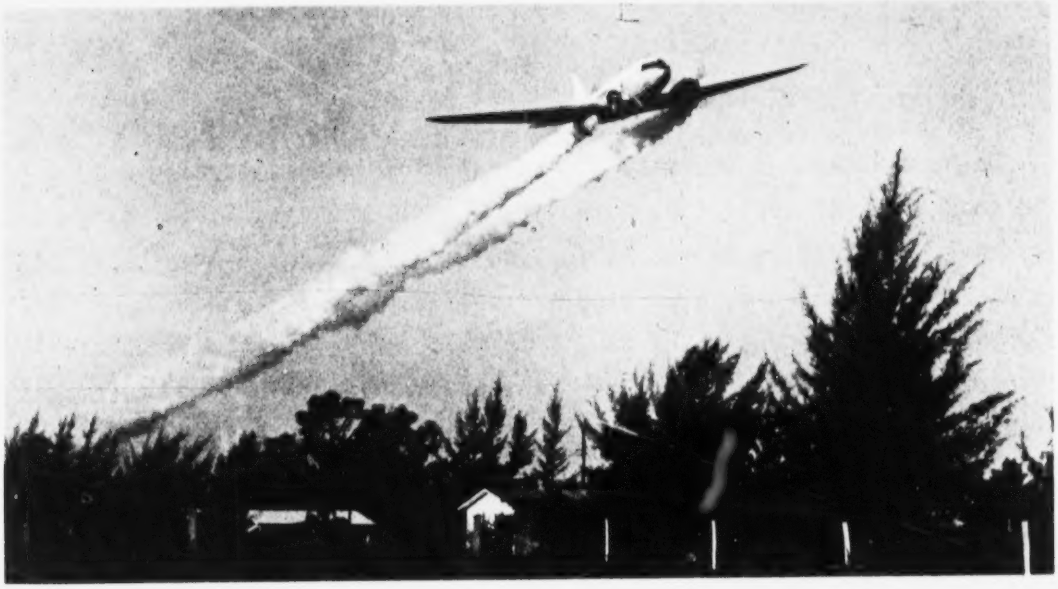
Actions	In Your Area?
Erosion control projects	____
Cleaning up neighborhoods or business districts (litter control)	____
Starting a recycling center	____
Conducting a scrap drive	____
Landscaping the school grounds	____
Improving wildlife habitat with projects such as . . .	
Habitat planting projects	____
Installing and servicing bird feeders	____
Building and installing nest boxes for birds such as bluebirds and wood ducks	____
Preserving important habitats for plants and animals that are native to the area	____
Planting evergreen windbreaks to conserve energy during the winter	____
Improving conservation practices in the home such as . . .	
Turning off lights when not in use	____
Repairing leaky faucets	____
Putting weather stripping around doors and windows	____
Lowering the thermostat	____

What other ecomanagement projects can YOU think of? Make a list below:

1. ____________________

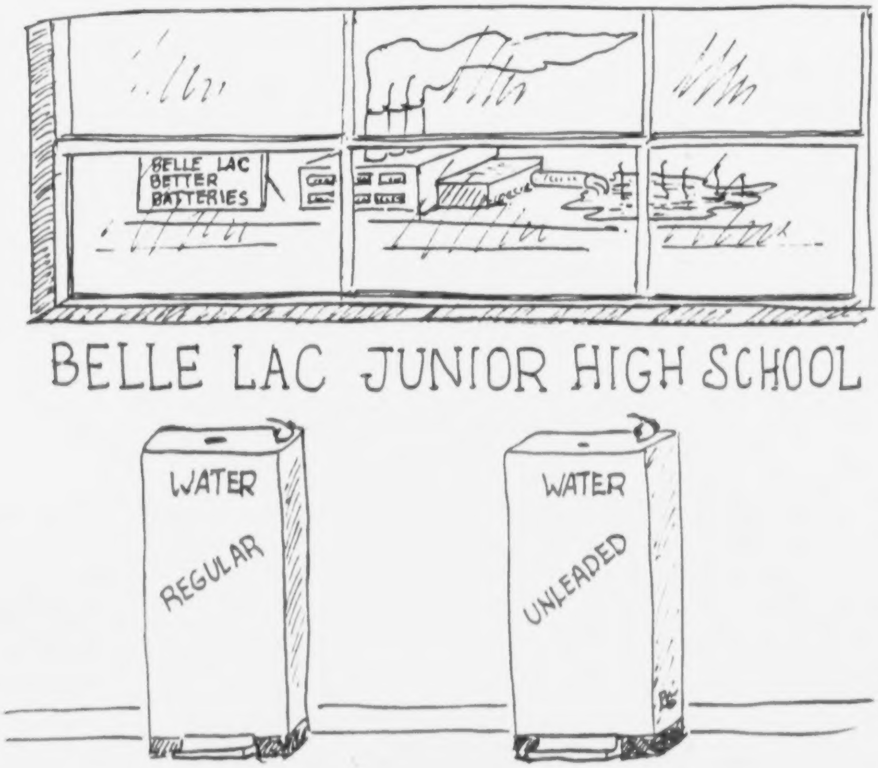
2. ____________________

3. ____________________



Spraying for Mosquitoes - West Coast of Florida.
(Photo courtesy H. R. Hungerford.)

This is a form of ecomanagement that is intended to improve the environment. From what you have learned about environmental action, do you agree that this action will have ONLY positive ecological consequences? Why?


BELLE LAC
BETTER
BATTERIES
BELLE LAC JUNIOR HIGH SCHOOL
WATER
REGULAR
WATER
UNLEADED

Applying Environmental Action Skills

We have looked at the many aspects of environmental action. It is time to see how to apply them to environmental problems. This is not an easy task. But, it is important for you to see how the many aspects of action can be applied to a particular issue.

The example we are going to use in this section is the issue of the pop can - one with which you may be very familiar. There is far more to this issue than can be included in this section. However, we will present enough information to show you how to go about applying the action skills. Let's get started.

I. Identifying the Problem:

POP CANS: Should the disposable pop can be used by consumers? If not, what actions should be taken?

II. Summary of the Issue:

POP CANS: Both positive and negative positions should be identified and described. This is the only fair way in which the issue can be summarized. The following is an attempt to do this.

In Support of Cans	Opposing Cans
Pop cans are convenient containers.	Pop cans have a high environmental cost.
Cans are safer than glass bottles.	There are acceptable substitutes available in returnable bottles - the product need is low.
The economy is already geared to the marketing and use of non-returnable cans.	Cans can also be dangerous when rusted and/or lying as litter in the environment.
Jobs will be lost by the change-over to returnable glass bottles.	New jobs will be created and workers can be retrained.

III. Conclusions:

POP CANS: From the environmentalists' point of view, pop cans cost the environment far more than they are worth to society. Action should be taken on this issue.

IV. Appropriate Actions:

POP CANS: Two general actions are possible. One is to encourage and participate in boycotting of beverages in non-returnable containers. The second action is to persuade a state legislator to sponsor a bill which would outlaw disposable beverage cans and place a mandatory deposit on all pop bottles. This political action could be followed by further lobbying to support the bill and get legislators to pass it. (NOTE: Some states such as Oregon and Michigan have already passed such laws.)

Both of the above types of action will have to be taken by both individuals and groups. To be effective, some state-wide as well as local environmental organizations must be willing to participate and money must be made available.

The actions will have to be taken at local, regional, and state levels. A total persuasion campaign, state-wide, will be necessary to inform the public and get their support.

V. Applying the Thirteen Criteria Questions: (POP CANS)

1. Is there sufficient evidence to warrant action on this issue?

The comparison of cost and needs assessments would indicate "yes". Cost, of course, refers to the environmental cost.

2. Are there alternative actions available for use?

A compromise action might be to develop a government supported recycling program to see that all cans are recycled. However, at this time, only aluminum cans can be economically recycled and the environmental cost is still high.

3. Is the action chosen the most effective one available?

Experience in other states which already have such a law indicates that both consumer boycott and political action are effective.

4. Are there legal consequences of this action?

Not if the actions taken are legal ones.

5. Will there be social consequences of this action?

Certainly an effect on the habits of the people will result. But, this should be positive.

6. Will there be economic consequences of this action?

In local areas jobs will be affected for short periods of time when a change from cans to bottles occurs. Also, some temporary effects on local supermarkets will be felt. Experience in other states indicates that the effects are temporary. In fact, more jobs are created in the long run and people can be retrained to make bottles instead of cans in factories.

7. Do my personal values support this action?

The action fits the values of the authors.

8. Do I understand the procedures necessary to take this action?

This depends. This module had only introduced you to the procedures. They will probably have to be developed in more detail if you choose to act on this particular issue.

9. Do I have the skills needed to take this action?

This also depends. However, organized environmentalists share the necessary skills. By working with a group, you immediately benefit from that group's skills.

10. Do I have the courage to take this action?

In some communities where can manufacturers are located, feelings might run very high AGAINST taking these actions. Therefore, the answer to this question might depend on where you live.

11. Do I have the time needed to complete this action?

This also depends. A great deal of time and commitment will be required to complete these actions.

12. Do I have all of the other resources needed to make this action effective?

Experience in other states indicates resources can be found if the environmentalists are organized. Therefore, the answer depends on whether good organization exists to work on this issue.

13. What are the ecological consequences of this action?

Research and experience in other states shows that the ecological consequences are positive. What might these consequences be?

VI. Recommendations: (POP CANS)

It appears as though the pop can exists as a serious environmental issue. Environmental action is certainly appropriate. Action should be initiated.

The Final Step (VI-9)

Back in Module V you identified and investigated an environmental problem which interested you. After completing Module VI you have an opportunity to carry your interest one step further.

Carefully analyze your research findings from Module V and, to these, apply the action skills from Module VI in order to plan a campaign of action to help solve the problem. Whether you take action will depend on your values and whether your work in these modules has persuaded you that you should become involved.

Are you persuaded to work for a better environment? The final decision is your's to make!

One Group's Decision

In the early 1970's a group of students in a course similar to the one you are in became very concerned because housing developers were filling in marine estuaries in order to get space to build houses. Estuaries are shallow, marshy areas where fresh water streams flow into and mix with ocean water. They are ecologically important because of the great amount of food and habitat they provide for young fishes and other marine animals.

The students formed an organization called P.Y.O. (Protect Your Environment) and used all of the skills discussed in this module to investigate the problem, select actions, and carry out a successful environmental action program to help solve the problem. They not only succeeded in saving the estuary, they were able to get a law passed which guaranteed that other such ecosystems on the east coast would be protected.

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

MODULE VI

ENVIRONMENTAL ACTION STRATEGIES

Objectives for Module VI

Overview:

In Module VI students are introduced to the basic elements of environmental action. They first define positive, negative and passive action, propose examples of each type and then defend their choices. They are introduced to the difficulty in classifying actions due to divergence of opinion on personal rights and the effects of particular actions on the environment. Students are then introduced, in detail, to specific modes of action, i.e., persuasion, consumerism, political action and ecomanagement. A discussion of individual and group action effects and categories of group action follows this discussion. Students are presented with a list of thirteen action analysis criteria which should be considered before taking any form of environmental action. Further, they apply these criteria to a specific example of environmental action. Finally, the students are given an opportunity to apply all of the action skills and knowledge to develop a plan for action concerning an environmental issue. They identify and summarize the issues, identify and evaluate possible actions and make a final recommendation concerning action on the issue.

Specific Objectives: As a function of Module VI the students will be expected to be able to . . .

1. . . . identify at least two reasons why it is difficult to classify a particular environmental action as passive, positive, or negative.

2. . . . propose one example of an environmental action which could be classified as either positive or negative and defend both of these classifications.

3. . . . define the action method of PERSUASION and identify at least two examples of strategies which could be used in this category.

4. . . . define the action method of CONSUMERISM and identify at least two examples of strategies which could be used in this category.

5. . . . define the action method of POLITICAL ACTION and identify at least two examples of strategies which could be used in this category.

6. . . . define the action method of ECOMANAGEMENT and identify at least two examples of strategies which could be used in this category.

7. . . . identify two advantages of group action which individual action cannot accomplish.

8. . . . given any of the thirteen action analysis criteria, explain why an individual should consider these before taking any type of environmental action.

9. . . . given a specific example of an environmental action, apply the thirteen action analysis criteria listed in Module VI.

10. . . . identify a given persuasive action as an emotional appeal, logical appeal, coercion, or combination of these.

11. . . . produce an example of an effective persuasive action on some issue which combines both logical and emotional reasons for taking action and follows the appropriate guidelines for persuasive action.

12. . . . describe the dangers of persuasive actions based only on emotion and give one example of an actual environmental issue in which such actions were taken.

13. . . . identify three different modes of persuasion and explain how each can best be put to use.

14. . . . select a product and perform both an ENVIRONMENTAL COST and a NEEDS ASSESSMENT on the product. Further, a recommendation must be made as to whether action should be taken regarding the product.

15. . . . identify three categories of consumer action and describe issues in which each form of action is appropriate.

16. . . . describe three kinds of political action and discuss how each of them may be effectively applied to environmental issues.

17. . . . identify three situations in your area which could require ecomanagement type actions.

18. . . . apply all of the action skills and knowledge in developing a plan for action concerning some environmental issue. This would include identifying and summarizing the issue, identifying and evaluating possible actions, and making a final recommendation concerning action on the issue.

SUGGESTIONS FOR TEACHING MODULE VI

Module VI introduces students to most of the basic strategies inherent in environmental action. The mode of legal action was purposefully not covered in the modules. Up to this point in these modules, the students have been engaged in activities revolving around identifying environmental issues and methods of securing information regarding those issues. This module exposes them to the array of actions they might use to help bring resolution to those issues. The advantages and disadvantages of persuasion, consumerism, political action and ecomanagement are discussed and students are given the opportunity to engage in surrogate activities involving each of these action modes.

Throughout this module, students are presented with examples of both positive and negative behaviors in response to environmental degradation. Both types of behaviors should be explored and the ramifications and responsibilities of such behaviors should be discussed, weighed, accepted, or rejected. The module is geared to challenge the students' abilities of synthesis, analysis, and evaluation rather than basic recall and memorization.

The module offers suggestions for real environmental action projects and it should be used with that end in mind. The authors recognize the tremendous significance of students being involved in environmental action projects and recommend this procedure as the culminating module activity. They also realize that it is both unfair and unethical tc demand that students take citizen action. However, it is hoped that students would be willing to take such action by virtue of their interaction with the information in Module VI. It is also hoped that their specific action decisions will be supported and assisted by their instructor. Environmental awareness without subsequent positive action is of little personal or societal value.

Any action which an individual takes is motivated by the beliefs and values which he/she holds. This is true also for environmental situations. In this module students are asked to make decisions regarding the quality of exemplified types of environmental action. Although values clarification activities per se are not utilized in this module, students must apply their own values to a number of value laden action situations.

There is a growing body of research data which indicates that knowledge has a direct bearing on value formation and value change. Students possessing greater amounts of environmental information also seem to be more willing to communicate and defend their values. It would seem logical then, as you progress through module activities to supplement the students' knowledge base with additional, valid information. The beneficial results of accurate, ecologically sound information in value formation must not be underestimated.

As with previous modules, the authors have attempted to describe each major action mode and present general guidelines for each action strategy. No attempt has been made to present models for every strategy presented. At times, by virtue of the nature of the material, the student has not been presented with an opportunity to fully apply the strategy in an actual situation. It is the hope of the authors that instructors using this module will assess their students and develop such models and application opportunities as determined by each specific situation.

CLASSIFYING ENVIRONMENTAL ACTIONS, VI-1, VI-2 (pages 134-136-SM). In Exercise VI-1, most students will decide that the commonality of the specific actions described rests in their being negative or detrimental behaviors toward environmental quality. Not all students may see this, due to disagreement about their personal rights and the effects of specific actions on the environment. In Exercise IV-2, it is recommended that students discuss their rationales concerning negative, positive and/or neutral stances toward each behavior. The discussion should bring out differing values. This is healthy, for within differences lies the crux and origin of environmental issues and diversity of behaviors. Do not expect instant conversion of those students who do not see the negative ramifications of certain behaviors. Hopefully, this will come in time as they receive further exposure to decision-making regarding environmental issues. Unfortunately, but also realistically, a few children will never accept certain behaviors as completely negative or positive. Such is the way of human nature as influenced by our values and beliefs concerning the environment. In fact, although frustrating for the teacher, it may be beneficial to have dissident opinions expressed in class for they can serve to strengthen existing positive value positions.

The values of the authors exhibit themselves in regard to the classification of actions in Exercise I-2. Items 1-6 are considered to be negative actions. The responses to Items 3 & 4 should elicit discussion in terms of personal rights versus environmental degradation. Item 5 can lead to a discussion of the national problem of solid waste buildup, removal, disposal sites, costs, etc. The topic of landlords' services to rental property and renter responsibilities to his home or business also are cogent here. In Item 6, the teacher may have to point out the problem caused by the lack of disintegration of aluminum and the subsequent effects this can have on the flora and fauna of the lake.

Item 7 receives a positive classification. Here the defense rests in the long term benefits of composting to enrich the soil. The odor is a short term nuisance which can be circumvented by proper construction of a compost pile. Application of lime usually deters odor, accelerates decomposition and adds mineral nutrients to the organic material.

Items 8, 9, and 10 - answers will vary. In Item 8, students might point out the relationship of increased gas consumption of inefficient pollution devices to the depletion of fossil fuel reserves. The danger of air pollution is a counter argument. Each is a legitimate position - a matter of values. In Item 9 - hopefully students will point out the double edged sword of extraneous water use in contrast to electric consumption to keep water cool. (See pp. 229-231 of the Earth Tool Kit, Pocket Books, New York, 1971 for a listing of average wattages of common household appliances.)

Item 10 - The advantages of zero population growth and its effect on food supplies and available space, psychological stress, etc. can be compared to religious and home life values. The emotionally positive effects of a larger family may be based on societal rationalization rather than empirical evidence.

In many of the above items, especially 8, 9, and 10, no concrete knowledge base exists from which values can be developed. It should be pointed out to students that, in many cases, their decisions should be tentative until more knowledge is available. As knowledge is gained, individuals can then behave consistently with desirable environmental goals.

The authors would recommend that you allow rational and disciplined arguments to take place in class. In fact, after you have covered the Action Analysis Criteria (page 144-SM), it is recommended that you return to these activities and apply the criteria to each of these situations so that students may evaluate the actions again in a new light.

THE ANECDOTE entitled "NEGATIVE OR POSITIVE" on page 137-SM may elicit both positive and negative responses. It presents fertile ground for the instructor to emphasize the divergence of opinions and actions due to differing values as well as an analysis of Lovejoy's actions when compared to the thirteen action analysis criteria.

AMERICAN BISON PHOTO (page 133-SM) - Although the photograph of the American bison does not carry a caption, it can be pointed out to the students that this animal's survival is a function of environmental action which was taken after 1900. The only reason that the bison survives today is because a handful of concerned Americans were willing to use their skills and time to establish a number of refuges for the "buffalo". You might suggest that this action drama be researched and reported on in class.

THE ENVIRONMENTAL ACTION MODEL (pages 139-144-SM) - This Action Model is presented as an interpretation of the ultimate goal of environmental literacy - that of overt, positive environmental action. The model contains three major components. The first component is a categorization of the major action modes. These are persuasion, consumerism, political action, legal action and ecomanagement. All specific environmental actions can be classified under one of these major modes. Although many authors of environmental education literature discuss one or more of these action components, this model is the only existing treatment of all categories of environmental action melded with an explanation of the levels at which these actions can take place.

You will find that legal action is depicted in the model articulation chart on page 141-SM. The authors have chosen not to present the students with instruction on legal action because they feel that middle school students would not be able to successfully accomplish legal action at this point in their lives.

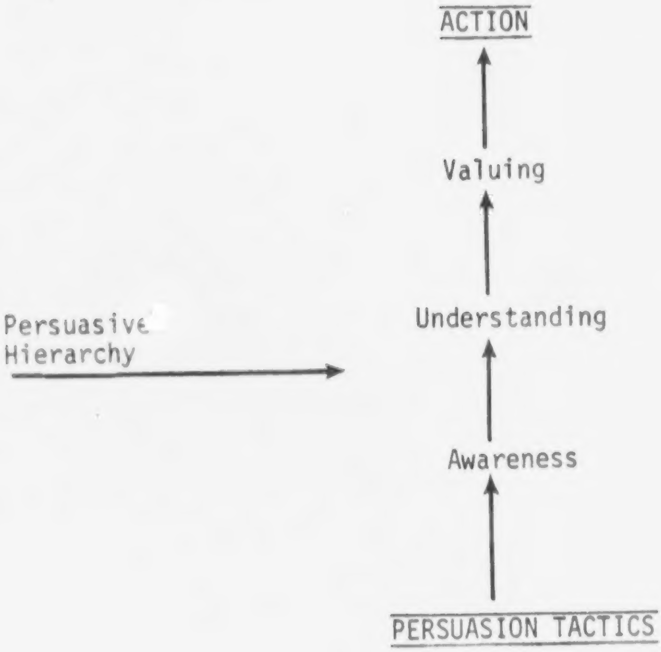
The second component of the Action Model is the identification of the levels at which action takes place. Action may be taken by an individual or by groups of individuals at various geographic levels, i.e., county, state, national, international. The merit of establishing levels of action lies in the concept that the scope of concern and the scope of effectiveness (power) of actions usually increases as these actions are taken by groups at higher organizational levels (see page 144-SM). It is not intended to communicate that actions should take place at only high levels of organizational structure. Actions do and should take place at all levels. The model should serve only as an analytic guideline to scope and effectiveness as specific actions are considered for particular environmental problems. For example, an effective anti-litter campaign might be accomplished at the community level whereas a campaign for the protection of an endangered plant species might necessitate action at a regional or state level.

The third component of the Action Model is the establishment of thirteen action analysis criteria (see page 144-SM) which should be applied by an individual to an environmental action prior to his taking that action. These criteria are phrased as questions. The answers to these questions serve as important guideposts which aid in the determination of the most appropriate action mode to take. In discussing the appropriate application of the criteria with your students, it is important to stress that any action taken should be the result of an ethical, ecologically sound decision.

EXERCISES VI-3, VI-4, VI-5 (pages 142-146-SM) engage the students in establishing criteria for environmental action decision-making, applying action analysis criteria to each of the four action modes and applying the criteria to a specific environmental action strategy. In Exercise VI-3, the students should compare their own guideposts to the list of criteria posed on page 144-SM. If new and useful criteria come out of this activity, they should be added to the thirteen found in the module. In Exercise VI-4, it should be pointed out that all the criteria are pertinent to all four modes of environmental action. It is presumed that, in Exercise VI-5, the students will decide not to proceed with toppling the tower. Such an action would not be ethical and it would have negative legal and social consequences. It might prove interesting to explore appropriate alternatives that Mr. Lovejoy might have taken.

PERSUASION AS AN ENVIRONMENTAL ACTION. Persuasive action may exist alone as a means of effecting a solution to a problem. More often, however, persuasive action techniques play a role in other action modes. For this reason, persuasion is the first action mode discussed in detail for the students. Persuasive approaches are identified as being logical, emotional, and coercive. Although coercion is considered to be a tactic of force rather than true persuasion, it is mentioned in Module VI because it is a technique used by environmentalists (usually in a legal context) to assure that positive action is taken. Coercion in the form of threats, intimidation, violence, etc. is dangerous and unethical. It is also ineffective once the external force is removed. Persuasion is most effective when the techniques used bring about an internalized behavior change.

Persuasion strategies can function at three levels within an individual. These levels are awareness, understanding, and valuing. These levels can exist in a hierarchical arrangement and this is diagrammed as follows:



Although all levels are important and related to each other, for a persuasive technique to be ultimately effective it must bring about a change in the values of individuals so that they prize and choose to take action.

EUTROPHICATION is discussed on pages 151-152-SM. It is important to note that eutrophication is a normal and natural aging process which takes place in bodies of water. Eutrophication becomes an environmental problem when specific factors such as phosphates increase the normal rate of the eutrophication process. Nutrients such as phosphates and nitrates simply contribute to excessive plant growth. Eventually these large numbers of water plants die which results in abundant decay. The decomposition process demands a great deal of oxygen which results in oxygen depletion of the water. If the oxygen level gets low enough so that aquatic animals can no longer survive, the situation is complicated by the death of populations of animals. This, of course, leads to more decay, even lower oxygen levels, etc., and a critical aquatic situation.

THE GUIDELINES FOR PERSUASIVE ACTION (page 153-SM) should be stressed with the students. The thirteen action analysis criteria listed on page 145-SM may yield further guidelines which could be added to those presented in the text.

CLASSIFYING ACTIONS VI-6 (page 154-SM) involves the students in analyzing the actions of two different environmental activists on the basis of logic, emotion, and coercion. The defense of the students' analysis is most important. It is also an opportunity to reinforce the use of the guidelines for persuasive action discussed earlier.

Further activities in persuasive action techniques are left to the discretion of the instructor. Some suggestions are:

1. Students can identify the types of persuasive approaches (logical, emotional) used in television and radio commercials, newspaper and magazine advertisements, etc. Identification of the value positions depicted in each would be valuable. The persuasive techniques used by pertroleum corporations, utility companies, lumber companies, and other special interest groups are particularly interesting.

2. Students can prepare a persuasive strategy of their own choosing, first using a logical approach and then modifying it to represent an emotional approach or, a student might want to combine the two types. Those strategies might be presented in class. The topic which the students autonomously researched in Module V might be most appropriate for this activity.

3. An exercise using a debate strategy is also very powerful. The instructor may need to model appropriate behaviors here since debate, although effective, is not a commonly taught strategy. Some debate questions which offer opposing positions are:

   a. Should predator control measures include the use of cyanide?

   b. Should rural land owners be permitted to subdivide or otherwise destroy productive farm land?

   c. Is abortion an acceptable population control method?

   d. Should controlled alligator hunts be allowed in Louisiana and Florida?

   e. Should automobile pollution control regulations be relaxed in order to conserve fossil fuels?

CONSUMER ACTION is an effective method of action for individuals and groups. The strategies of direct boycotting and consumer conservation are rather clearcut. Indirect boycotting is more difficult to conceptualize in that it is a persuasive consumer action directed at bringing about a change that is related to a product but not a change in the product itself. The indirect boycotting of Japanese goods did not eliminate the use of whale oil but it did effect a change in the manner in which whales were hunted--a manner which could have severely endangered certain whale populations if left unchecked. Indirect boycotting is also often used in non-environmental issues.

The type of consumer action taken does not only depend on the environmental issue. It also depends upon a careful appraisal of the environmental costs and consumer needs of the product in question. In this module students are introduced to an environmental cost-needs assessment regarding metal pop cans. The pop can issue can serve as a model of performance for the students as they engage in cost-needs assessments on products of their choice. The instructor should have the students closely inspect the types of questions posed in the assessment. Manufacture, transport and disposal costs are explored as well as the basic costs of materials, environmental damage and environmental repair. If the instructor should choose to have the students carry out another cost-needs assessment in order to gain experience in the technique, caution the students to explore all avenues of needs and cost and to generate appropriate questions regarding the product. Cost-needs assessments are not, however, an end in themselves. They are merely the vehicle which an individual or groups of individuals use to determine the appropriate consumer action to take. Applying cost-needs assessments requires students to use the research skills they learned in previous modules. The instructor should allot adequate time for such research to take place.

In EXERCISE VI-7 (page 158-SM) students are given the opportunity to complete a needs assessment of pop can use. Encourage the students to apply the guidelines for assessing product need in the exercise. The determination of real or imagined need and the environmentally desirable substitute available may be relatively easy tasks. However, the question of valuing the benefits of the product more than the costs to the environment is a heady one and is often answered emotionally. Objectivity on the part of the students and instructor are imperative when applying the guidelines for assessing need.

Consumer conservation is identified in Module VI as a consumer action. Some students may recognize that consumer conservation is a form of ecomanagement. This is, indeed, the case. However, since ecomanagement also includes many non-consumer related tactics, it is treated as a more encompassing action mode of which consumer conservation is just one facet.

As a final activity for the consumer action phase of this module, it is recommended that students apply cost-need assessments to various products and subsequently debate the need for action. As groups or individuals, they can then plan types of consumer action which might be used. Some students may also incorporate persuasive actions along with consumer strategies. If the actions chosen are appropriate ones, the students should be encouraged to carry them out.

POLITICAL ACTION encompasses such activities as voting, campaigning and lobbying. Each of these specific actions contain elements of persuasive action. If an environmentalist chooses to campaign for a political candidate, he is in fact employing persuasion tactics to convince individuals to vote in a certain way. Political action, then, involves knowing how, when, and where to apply persuasion. This necessitates taking an active part in the decision-making process inherent in the political structure at local, state and national levels.

This portion of Module VI only attempts to make students aware of the elements of political action. It is not designed to teach students the intricate steps of political action. It is not left to the instructor to help the students learn about the local and state political structure (if this is deemed desirable). The procedures of the law making process might be examined so that students are aware of the points in this process where political action can be taken. Such legislative information might be taught by the social studies teacher in a team teaching arrangement.

In order for students to become successful political activists, they need to be well informed. Public news media (radio, television, newspapers) should be utilized so that students become aware of the environmental values of political candidates and the important issues that are currently being considered by government. Environmental organizations such as the Sierra Club and the National Wildlife Federation are other important sources of information. The authors of the modules have listed a wide array of such organizations and their addresses on pages 51-54-SM in Module II.

If students become interested in joining environmental organizations, they need to carefully select the groups in which they become active. Considerations for joining organizations include:

1. Are the goals of this organization consistent with my environmental values?

2. Are the actions which this organization employs ethical as well as effective?

3. Am I willing to commit myself to the goals and actions of the organization?

4. Of what value will my membership in this organization be to myself and to the group?

Your students may very well develop other considerations and should be encouraged to do so.

No specific activities are presented to the students regarding political action. Some interesting activity ideas which the instructor can use at this point in the module are:

1. Students can develop a set of environmentally appropriate guidelines for voters to use in selecting candidates for which to vote.

2. Students can prepare a list of ways in which every voter can remain informed on the candidates and the issues.

3. Students can evaluate a candidate's past congressional voting record and determine whether the candidate has used an environmental ethic in political decision-making.

4. Students can select a specific environmental issue and an appropriate political official and compose an effective letter urging that specific action be taken.

ECOMANAGEMENT involves actual physical manipulation of the environment in order to improve its quality. Ecomanagement projects are direct action and can serve also as persuasive modeling behaviors for other individuals. As individuals become interested in taking an ecomanagement form of action, they should again assess their action choice by using the thirteen action analysis criteria. In ecomanagement activities, criteria #13 (What are the ecological consequences of this action?) should be especially considered.

For example, if students attempt a full scale newspaper recycling project, they should carefully assess the type of collection method they use. If they were to use a large truck for door to door collection, the environmental costs from air pollution and fuel use might surpass the environmental gain from recycling the papers.

EXERCISE VI-8 (page 162-SM) responses will vary for each teaching situation. The authors realize that the list is not all inclusive. In fact, it is suggested that the instructor consider involving his/her students in an ecomanagement needs assessment within the community. After a thorough survey of such needs, the students could then select an ecomanagement project and again apply the thirteen action analysis criteria to determine the appropriate strategy to follow in the project. Perhaps several groups could use the same or different issues and compare recommendations. It is hoped that the students would ultimately desire to carry out the action.

APPLYING ENVIRONMENTAL ACTION SKILLS (page 164-SM) presents the students with a model in which action and investigation skills are applied to a particular environmental issue. The model provides sample responses to the thirteen action analysis questions. These responses should help students see how these criteria help determine the viability of a chosen action and direct the decision-making process.

Few environmental actions which are taken can be clearly classified as being one specific type of action mode. In reality, an action plan and the subsequent action will probably be a combination of several action modes. For example, an ecomanagement project may incorporate persuasion and consumer strategies as well as a direct physical action. Previous to this section, students have been exposed to the action modes as semi-isolated entities. It should be emphasized that action plans should synthesize those action modes which are most appropriate to the environmental problem in question. As always, the thirteen action analysis criteria should be applied whether a single mode or a combined action strategy is being comtemplated.

EXERCISE VI-9 (page 167-SM) requires students to develop an action plan for an issue of their choice. It is recommended that they use the issue which they investigated during the autonomous research phase of the modules. If students wish to work together on action plans, they should be allowed to do so.

The instructor must establish his/her expectations for the final product (needs assessment; selection and evaluation of action) and explain the final reporting format to students. The form used in pages 164-167-SM is one option. However, the authors would expect the data and discussion sections to be more detailed and lengthy than those which were abbreviated in the model. A second option would be to use the outline which follows, which the instructor can set up into a student worksheet.

YOUR ACTION PLAN

A. Name of the Issue:

B. Issue Analysis (the players, their positions, beliefs and values):

C. Your position, beliefs or values regarding this issue:

D. 1. Appropriate Actions
   2. Which action I (we) choose to analyze?:

E. Application of the Action Analysis Criteria:

1. Is there sufficient evidence to warrant action on this issue?
2. Are there alternative actions available for use?
3. Is the action chosen the most effective one available?
4. What are the legal consequences of this action?
5. What are the social consequences of this action?
6. What are the economic consequences of this action?
7. Do my personal values support this action?
8. Do I understand the procedures necessary to take this action?
9. Do I have the skills needed to take this action?
10. Do I have the courage to take this action?
11. Do I have the time needed to complete this action?
12. Do I have all of the other resources needed to make this action effective?
13. What are the ecological consequences of this action?

F. Final Decision - Is the action chosen in D2 the one I would choose to take? _____ Yes _____ No Why?

An ending note to this module seems pertinent. The anecdote on page 167-SM is a true one. Students can and do actually carry through with environmental action. Although we, as authors, cannot demand that your students DO take action, we hope that they will autonomously choose to do so. The purpose of this module is to give students the action skills necessary to accomplish the task. In the final analysis, we hope that knowledge of action skills will encourage them to become citizens who are not only environmentally aware but who are environmentally active.

INVESTIGATING AND EVALUATING ENVIRONMENTAL ISSUES AND ACTIONS: SKILL DEVELOPMENT MODULES

TEACHER'S EDITION

APPENDIX A

EXPERIMENTAL RESEARCH

EXPERIMENTAL RESEARCH

The absence of a module dealing with the experimental research technique is not unintentional on the part of the authors. First, the authors' experience teaching middle-school students indicates that at least 90% of the students will choose other modes of investigation when they have an opportunity to choose from all available alternatives. Second, most of the variables that middle-school students or anyone else would have to deal with in environmental education are extremely difficult to recognize and control properly in a laboratory situation. Third, those variables that are workable in a laboratory situation require sophisticated equipment that is not readily available in most public schools.

About this time you are probably in a panic saying, "Yes, but what do I do with the 10% of the student population that may choose a problem requiring the experimental technique?" DON'T PANIC! First cover the first four modules thoroughly and carefully. Second, when your students select their problem areas in Module V, identify those students who choose a problem that requires experimentation and variable manipulation. (NOW, PANIC!) At this point, either in small groups or individually, explain what an experiment is by relating it to the nature of the problem areas they have chosen. Next, explain what the components of an experiment are, the importance and function of each. You may want to use the following model for your explanation or perhaps better yet, you can relate each model component to one or all of the problems chosen by the students.

Components of An Experiment

> Experiment: An experiment is nothing more than the planned process of making something happen under conditions controlled by the experimenter. An experiment is actually a situation planned and set up by the experimenter, which will give him the answer to a specific question, because all other conditions or possibilities have been eliminated.[1]

An experiment usually (not always) begins with a question that has resulted from the observation of some discrepant event that occurred at a particular time under observable circumstances. For instance, the question, "What is responsible for dead fish and large algal blooms in polluted streams and ponds?", may have resulted when someone noticed that large algal blooms and dead fish occurred in streams and ponds that received large quantities of detergents and/or agricultural fertilizers. Consequently, the experimenter develops a design that will allow him to answer the question(s) posed as a result of his observations. The experiment designed should consist of the following seven components:

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[1] Philip Goldstein, How To Do An Experiment. (Chicago: Harcourt, Brace and World, Inc., 1957), p. 37.

COMPONENT	EXAMPLE
I. RESEARCH PROBLEM Rationale: Without a problem to solve, there is really no need for experimental investigation. When a problem is present, it should be communicated clearly and concisely.	I. Statement of the Problem: Large algal blooms and dead fish appear in some polluted streams and ponds.
II. RESEARCH QUESTION Rationale: The question allows us to guess or hypothesize a logical outcome should we decide to experiment to try to find out what is causing the problem.	II. Statement of the Question(s): What variable is responsible for dead fish and large algal blooms in polluted streams and ponds? Variable: Any factor that is likely to affect the outcome of the experiment e.g. temperature of water, kind of fish present, type of algae present.
III. RESEARCH HYPOTHESIS Rationale: The hypothesis gives us something precise on which to design an experiment. The hypothesis must identify exactly what it is we are testing. The factor to be tested is called the EXPERIMENTAL VARIABLE. This becomes the one variable around which the whole experiment is designed. In some instances, more than one hypothesis may be formulated. An experiment may have to be designed to test each hypothesis. The variable which may be affected by the experimental variable is called the RESPONDING VARIABLE.	III. Statement of the Hypothesis(es): It appears as though streams and ponds that have large algal blooms and dead fish are also streams that receive large quantities of detergents and/or agricultural fertilizers. Phosphorous is found in large quantities in some detergents and in many argicultural fertilizers. Consequently, it is hypothesized that chemical compounds containing phosphorous are responsible for the dead fish and large algal blooms in streams and ponds. Experimental Variable: Phosphorous (Phosphates) Responding Variable: Occurrence of dead fish and large algal blooms.

COMPONENT	EXAMPLE
IV. EXPERIMENTAL DESIGN Rationale: This part of the experiment produces a technique which will probably yield good, scientifically accurate data. Actually, this part of the experiment guides the scientist in his search (or in the testing of his hypothesis). You will note that everything in this design is constant. This means that ALL variables are carefully controlled EXCEPT one - the experimental variable. This is of critical importance because our experimental variable is phosphates - we must be able to determine whether phosphates are, in fact, responsible. Therefore, only the amount of phosphates in each pond will be allowed to vary!!	IV. Experimental Design: We design an experiment which will test what happens when algae and fish are exposed to various quantities of phosphates. This could be done in several ways. A number of similar outside ponds could be constructed to be used for this purpose. It is, however, absolutely necessary that the ponds ARE similar in all respects. We then would plan to introduce identical quantities of algae and fish into EACH separate pond. Following this, we would place different amounts of phosphates in each pond and over time critically observe the results of this strategy. One pond would receive NO phosphates! This pond would be called our control pond.
V. INVESTIGATION AND DATA COLLECTION Rationale: This part of the experiment follows the experimental design exactly! If the design is valid then this step will guarantee scientifically accurate data. Measurements taken must be exact and recorded in a manner that will be completely accurate.	V. Investigation and Data Collection: Here the experiment is carried out. Ponds are built, water added, fish and algae in exact and identical amounts are added to each pond. Varying, measured amounts of phosphates are added to each pond (EXCEPT the control pond). Observations of the fish and algae are made over time. These observations are recorded accurately.

COMPONENTS	EXAMPLE
VI. DATA REPORTING Rationale: The scientist is ethically obligated to report his findings to other scientists for examination. Consequently, the data collected must be accurately reported and organized in a logical, orderly manner.	VI. Data Reporting: In this part of the experiment, the experimenter organized his data for reporting. This organization and reporting can use any logical means of communication. Included can be charts, tables, graphs, and simple paragraph summaries.
VII. CONCLUSIONS, INFERENCES, AND RECOMMENDATIONS Rationale: The data must be interpreted carefully and accurately. It is on the basis of this interpretation that valid conclusions regarding the hypothesis are made. Inferences and recommendations will follow from the conclusions.	VII. Conclusions, Inferences, and Recommendations: Refer to Module IV.

Note: If the above example was to be implemented as it exists one would certainly run into some serious research validity questions. It is entirely possible that the experiment could be successfully conducted and the hypothesis accepted. This would be one of those cases in science when a successful experiment was conducted on the wrong hypothesis. Why? Because phosphates are not directly responsible for dead fish following an algal bloom. The relationship is an indirect one in that the phosphates serve as nutrients and produce an environment in which plants grow and reproduce excessively. This excessive growth is followed by the death and decay of an inordinate number of plants. The decomposition process demands huge amounts of oxygen. This results in oxygen depletion of the water. It is, therefore, largely a lack of sufficient oxygen that causes the fish to die. Therefore, the original hypothesis was actually inaccurately generated and stated.